IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XXI OCTOBER 1942

COOK (C.). **Some aspects of tree surgery in Canada.**—*Ann. appl. Biol.*, xxix, 2, pp. 205–208, 1942.

A plea is made for training tree surgeons and employing them on a municipal basis. Much harm is stated to be done to trees in Canada by unskilled men. A tree surgeon's work is outlined and methods given of climbing trees, pruning, cabling, filling cavities, and spraying against pests and diseases.

ZENTMYER (G. A.). **Toxin formation by Ceratostomella ulmi.**—*Science*, N. S., xcv, 2472, pp. 512–513, 1942.

Experiments carried out at the Connecticut Agricultural Experiment Station since 1940 have demonstrated that *Ceratostomella ulmi* [*R.A.M.*, xxi, p. 231], when grown in culture on a liquid nutrient solution containing yeast extract, produces a soluble toxic substance [cf. ibid., vi, p. 518], which is evidently the primary factor in the production of Dutch elm disease symptoms.

Toxicity was tested by filtering off the fungus after 12 to 25 days' growth, injecting the sterile filtrate into small American elms, and testing its effect on various plant cuttings. When the toxin was injected into healthy elm seedlings, typical symptoms of Dutch elm disease resulted. Young leaves wilted and died, older leaves curled upwards or developed necrotic spots, all walls were discoloured for long distances from the point of injection, and dark gums plugged the vessels. Tomato, elm, snapdragon [*Antirrhinum* sp.], and maple cuttings placed in tubes containing the filtrate from fungus cultures wilted severely, generally in one to four hours. Uninoculated nutrient solution failed to affect elm trees or plant cuttings, while control solutions adjusted to the P_H of the fungus filtrate also had no effect.

When filtrate from a 25-day-old culture was injected into five potted elms and ten 3 to 4 ft. tall in nursery rows, the symptoms described above appeared on all in three days. On five trees injected with 75 c.c. of filtrate 20 per cent. of the leaves were killed, on an average, and the height of discoloration of the wood averaged 24 in. above the point of injection; the corresponding figures for five trees injected with 200 c.c. of filtrate were 29 per cent. and 29 in. Slight toxin formation was found after three days' growth of the fungus, production reaching a maximum after 12 days' incubation. Toxin production was closely related to the growth vigour of the culture.

The toxin was not enzymatic, was adsorbed by activated charcoal, was removed from aqueous solution by an excess of toluene; and was 'antidoted' by several organic chemicals. The possibility of controlling Dutch elm disease by chemotherapy is suggested.

BUCHANAN (W. D.) & SMUCKER (S. J.). **Reactivation of Ceratostomella ulmi in occluded infections and contamination of Scolytus multistriatus.**—*J. econ. Ent.*, xxxv, 2, pp. 178–180, 1942.

When adults of the elm bark beetle *Scolytus multistriatus* were allowed to feed under controlled conditions on 229 *Ulmus americana* trees with occluded infections of

Ceratostomella ulmi [*R.A.M.*, xxi, p. 273] at Morristown, New Jersey, no conclusive evidence was obtained of the reactivation of the fungus through feeding injuries inflicted by 11,400 beetles. The pathogen was isolated from four out of 529 insects collected while feeding in the twig crotches and trunks of the same trees, but not from those occupying any of the 230 oviposition galleries removed from uncontaminated trap logs. Three out of 234 beetles taken while feeding in the twig crotches of trees with a current infection also yielded *C. ulmi*, which was further recovered from three out of 15 collected from oviposition galleries in course of construction in a tree having both an occluded (one- and two-year-old) and an active infection.

URQUIJO LANDALUZE (P.). **Nuevo metodo de lucha contra la 'tinta' del Castaño.** [A new method of control of the 'ink disease' of Chestnut.]—*Bol. Pat. veg. Ent. agric., Madr.*, x, pp. 15–32, 7 figs., 1941.

The essential features of the writer's method of combating the ink disease of chestnuts (*Phytophthora cambivora*) by decortication and the treatment of the exposed surfaces with copper oxychloride or copper carbonate, now practised on a wide scale in Spain, have already been noticed from another source [*R.A.M.*, xxi, p. 354].

DAVIS (S. H.). **An effective control for leaf blight of English Hawthorn.**—*Bull. Morris Arbor. Univ. Pa*, iv, 1, p. 11, 2 figs., 1942.

For some years past an English hawthorn (*Crataegus oxyacantha* [var.] *rosea-plena*) outside the Morris Arboretum, Philadelphia, has been heavily infected by leaf blight (*Entomosporium thuemenii*) [cf. *R.A.M.*, vii, p. 99]. The fungus has caused an annual defoliation of all the trees of this species in the vicinity, the boughs becoming leafless before the first of September. In 1941, the tree in question was sprayed with Bordeaux mixture (4–4–50) at bud break (16th April), and the treatment was repeated on 22nd and 30th April. On 1st October, the tree was still bearing good, though rather spotted foliage, while the others in the vicinity were almost leafless.

TERRIER (C. A.). **Über das Auftreten der Rhabdocline-Douglasienschütte in der Schweiz.** [On the occurrence of the *Rhabdocline* needle-fall of Douglas Firs in Switzerland.]—Reprinted from *Schweiz. Z. Forstw., 1942*, 1, 5 pp., 1942.

Phaeocryptopus gaeumanni is so widespread on Douglas firs in Switzerland [*R.A.M.*, xvii, pp. 638, 714] that its detection in 1941 in a nursery near Lausanne occasioned no surprise, whereas the presence of *Rhabdocline pseudotsugae* on the same needles was quite unexpected, this formidable pathogen not having been previously recorded (according to E. Gäumann) south of the Main. Presumably the latter fungus was introduced into Switzerland on the trees, which were procured in 1933 as three-year-old plants from Schleswig-Holstein (Germany). Before the discovery of *R. pseudotsugae* on the Douglas firs, a consignment had been dispatched to Dielsdorf, near Zürich, so that two foci of infection now exist in Switzerland. The writer takes this opportunity to recapitulate the outstanding features of the symptomatology, morphology, pathogenicity, geographical distribution, mode of spread, and control of *R. pseudotsugae*.

SANGSTER (R. G.). **The durability of some Uganda timbers and poles in the ground. Parts I and II.**—*E. Afr. agric. J.*, vii, 3, pp. 122–126; 4, pp. 208–211, 1942.

On the basis of preliminary tests extending over a period of 4 to 5½ years under very exacting conditions in a clearing on deep red clay soil with a black humus surface layer at an altitude of 3,600 ft. near the Budongo Forest Station, Uganda, with a mean annual rainfall of 60·52 in., and a temperature range of 11° to 30° C., the woods recommended for large-scale constructional purposes in parts of the Protectorate having a similar climate are *Albizzia coriaria, Chlorophora excelsa, Cynometra alexandri, Erythophleum guineense*, and *Mildbraediodendron excelsa*, none of which showed more than 4 per cent. failures due to [unspecified] fungal rot and/or termites in four years.

The following species merit trial for the provision of poles for native dwellings, small temporary buildings, and the like. *A. zygia*, *Combretum binderanum*, *C. gueinzii*, *Dalbergia monoxylon*, *Hexalobus monopetalus*, *Hymenocardia acide*, *Lasiodiscus mildbraedii*, *Markhamia platycalyx*, *Teclea nobilis*, *Terminalia brownii*, and *Zizyphus mauritania*. Some of the weaker timbers, e.g., *Maesopsis eminii*, responded favourably to preservative treatment by boiling in creosote and paraffin (1:1). *Celtis zenkeri* (untreated) should prove suitable for telegraph poles or comparatively heavy temporary structures.

LINDGREN (R. M.). **Temperature, moisture, and penetration studies of wood-staining Ceratostomellae in relation to their control.**—*Tech. Bull. U.S. Dep. Agric.* 807, 35 pp., 4 pl., 4 graphs, 1942.

Significant differences in reaction to temperature were found to exist among eleven isolates of *Ceratostomella* [*R.A.M.*, xxi, p. 175] on malt agar, including seven cultures of *C. pilifera* of varying geographical origin, *C. coerulea* from Canada and Sweden, *C. pluriannulata*, and *C. ips*. The *C. pilifera* isolates fell into two distinct groups differing from 2° to 4° in optimum and maximum temperatures for growth. The approximate critical points for the low-temperature group of this species and of the Canadian isolate of *C. coerulea* lay at 3°, 25° to 26°, and 31° to 34° C.; and for the high-temperature group and *C. pluriannulata* at 4°, 27° to 29°, and 34° to 35°. *C. ips* failed to grow at 50°, made fairly rapid growth at 35°, and had cardinal points varying 2° to 8° above those of the other isolates. In all cases an increase of 5° to 8° above the optimum resulted in inhibition of growth, whereas a decrease of 5° to 8° below the optimum never reduced growth more than 40, and usually not more than 25 to 30 per cent., a drop of 20° or more being required to inhibit growth completely. Daily growth increments at a given temperature were not constant for any of the fungi, but neither was there any indication of a definite periodicity in rate of growth, or a determinable increase or decrease in rate of growth with time. The time of appearance of brown hyphae and the rate of change from hyaline to brown varied with the different isolates and temperatures. Brown hyphae appeared earlier and the change from hyaline to brown in hyphae of a given age was more rapid at temperatures near the optimum point. A direct correlation was found to exist between cardinal temperatures for growth in culture and viability of the isolates at unfavourably high temperatures. Loss of viability occurred relatively early at temperatures only slightly higher than the maximum points for growth: for *C. coerulea* and both groups of *C. pilifera* after 7 or 14 days at 35°, for all isolates except *C. ips* after two days at 40°, and for *C. ips* after 7 days at 40°. Daily changes of temperature between the near-minimum and near-optimum points (5° to 30°) for growth had no effect on the development of *C. pilifera* and *C. ips*. Both organisms appeared to adjust themselves immediately to the new thermal conditions and continued to grow at a normal rate for that temperature. But when the cultures were subjected for one day to temperatures slightly above the maximum points for growth (35° and 40°, respectively), increment was retarded for about two days.

The reaction of *C. pilifera* to different temperatures on surfaces of *Pinus echinata* wood was in general the same as on agar, the penetration of hyphae being most rapid at temperatures favouring rapid growth on agar. The rates of longitudinal penetration into the wood were closely similar to those of the radial growth on agar, while radial penetration into the wood was about one-half to one-fifth that of the growth on agar. The average temperatures within piles of timber seasoning at three sawmills were found to range from 1·3° to 6·1° below those of the surrounding air, the highest temperature recorded within any one pile being 31·5°. It is concluded that high temperatures are not an important limiting factor in the discoloration of timber during air seasoning. A moisture content of approximately 24 per cent. (oven-dry weight basis) was found to be the lower limit for staining blocks of *P. echinata* sapwood, only very

slight development of short, thick, heavy-walled filamentous hyphae being noted at moisture contents between 23 and 24 per cent. Mature brown hyphae capable of causing discoloration were relatively abundant after ten days at moisture contents above 29 per cent., infrequent at 27 to 29 per cent., and absent below 27 per cent. Serious staining is not considered likely to occur in wood below the fibre saturation point. Except for the first 24 hours, daily rates of penetration into *P. echinata* sapwood by *C. pilifera* were approximately 0·5, 1, and 4·5 mm. in the tangential, radial, and longitudinal directions, respectively. Penetration was slightly, but not significantly, less rapid in summer than in spring wood; radial penetration was two to three times greater in steamed than in unsteamed wood.

A comparison of the depths of penetration of antiseptic solutions (5 per cent. sodium bichromate, 5 per cent. sodium dinitrophenolate, 10 per cent. hydrochloric acid, 4 per cent. zinc chloride, and ethyl mercuric chloride) applied as 10-second dips, with the rates of hyphal penetration of *C. pilifera* into *P. echinata* wood, showed that under the most favourable conditions for growth the hyphae penetrated beyond the depths reached by the solutions when treatment was delayed 48 hours after inoculation. Still longer delays resulted in complete discoloration of the interiors of the test boards except for an outer zone of 1 to 4 mm. It is concluded that a period of more than one day's delay is not advisable, if control of stain in timber is to be efficient.

Mellecker (J. B.). & Baker (M. W.). **Expected service effectiveness of preservative treatments applied to millwork. A laboratory method of comparison.**—*Industr. Engng Chem.*, Analyt. Ed., xiv, 4, pp. 305–308, 3 figs., 1942.

A detailed, tabulated account is given of experiments to determine the relative preservative efficacy of a number of treatments applied for the control of blue stain (*Hormiscium gelatinosum*) [*R.A.M.*, xix, p. 378] to test blocks of *Pinus ponderosa* sapwood, used for window sashes, rails, and the like [ibid., xviii, p. 285], some of which were painted prior to the standard three-minute dip in the fungicidal solutions. These were evaluated by means of a scale from 0 to 3·0, on the basis of which all treatments with an average rating of 2·0 to 3·0, 1·0 to 2·0, and 0 to 1·0 were classed as low, medium, and high in resistance, respectively. None of the 'paint-inoculated' specimens showed sufficient fungal growth for evaluation by these standards: the treatments applied to the unpainted wood were ranked as follows. The low-resistance class (2·67) contained only two preparations, viz., 5 per cent. 2-chloro-ortho-phenylphenol and 95 per cent. mineral spirits (all percentages reckoned by weight); six fell into the medium group (1·5), i.e., 5 per cent. pentachlorophenol, 5 per cent. diacetone alcohol, 90 per cent. mineral spirit, 2 per cent. 2-chloro-ortho-phenylphenol, 1·5 per cent. pentachlorophenol, 1·5 per cent. tetrachlorophenol; and eight into the high-resistance category, namely, 1·5 per cent. 2-chloro-ortho-phenylphenol, 2 per cent. pentachlorophenol, 1 per cent. tetrachloro-phenol, 0·5 per cent. sym-trichlorophenol, 5·15 per cent. 2-chloro-ortho-phenylphenol, 13·75 per cent. water repellent, 2 per cent. pine oil, and 79.10 per cent. mineral spirits.

Theden (Gerda). **Untersuchungen über die Feuchtigkeitsansprüche der wichtigsten in Gebäuden auftretenden holzzerstörenden Pilze.** [Studies on the moisture requirements of the most important wood-destroying fungi occurring in buildings.]—*Angew. Bot.*, xxiii, pp. 189–253, 1941. [Abs. in *Chem. Zbl.*, cxiii(i), 16, p. 2083, 1942.]

Although *Coniophora cerebella* [*C. puteana*], *Poria vaporaria*, *Merulius lacrymans*, *Lenzites abietina*, and *Lentinus lepideus* [*L. squamosus*] were experimentally shown to be capable of growth on pine sapwood at a relative humidity of somewhat below 94·5 per cent. (fibre saturation point), they did not attack the wood under these conditions. *C. puteana* showed the highest degree of resistance to drought, its mycelium developing at 94·5 per cent. relative humidity. For the effective control of a fungus that has once

become established, the relative humidity must be lowered to a point below that required for the prevention of primary infection. A high water content of the wood, involving the occupation of the cavities, acted adversely on *M. lacrymans* and *C. puteana*, but was of no avail against the other fungi under observation.

KNIGHT (A. G.). **Waterproof glues.**—*Wood, Lond.*, vii, 6, pp. 109–112, 1 fig., 1942.

It is pointed out that plywood and the glue lines in it are liable to attack and destruction, under damp conditions, by various micro-organisms. A method developed by the mycologists at the Forest Products Research Laboratory, Princes Risborough, is described, which makes it possible to distinguish the harmful effects due to damp alone from those due to the attack by micro-organisms. It involves the exposure of samples to dampness under sterile conditions where the development of micro-organisms is inhibited by means of antiseptics, and under non-sterile conditions, where it is encouraged by the addition of nutrients. As a result of many tests by this method the adhesives have been classified as follows. Those unaffected by attack of micro-organisms: (1) phenolic resin glues, of the film or liquid type, whether hot- or cold-setting, and (2) all types of urea resin glues, either neat or extended with not more than 33 per cent. of flour; and adhesives that can be destroyed by micro-organisms: (1) urea resins extended with more than 50 per cent. of flour, and (2) all types of casein glues. The exact amount of flour that can be mixed with urea resins without impairing their resistance to micro-organisms remains uncertain. Attempts to improve the resistance in much extended urea resins (75 per cent. of flour and more) and in casein glues by the addition of fungicides such as beta-naphthol pentachlorphenol and its salts, and copper chloride in amounts varying from $\frac{3}{4}$ to $2\frac{1}{2}$ per cent., failed in every case to improve the durability of the glue. It is concluded that in a glue line likely to be exposed to damp, the adhesive should be a phenolic resin or a urea resin to which not more than 50 per cent. of flour has been added.

ANDERSON (H. W.), THORNBERRY (H. H.), & FULTON (J. P.). **Use of eradicant sprays for the control of Asparagus rust.**—*Phytopathology*, xxxii, 5, pp. 419–423, 1942.

Illinois asparagus-growers have become alarmed of recent years at the extension of rust (*Puccinia asparagi*) in their plantings, even among the repeatedly resistant Martha and Mary Washington varieties [*R.A.M.*, x, p. 288], and a preliminary series of tests was carried out at Urbana in 1940 to determine the value of an eradicant spray, elgetol (sodium dinitro-ortho-cresylate) [ibid., xxi, p. 383], at a strength of 0·5, 1, or 2 per cent. and a dosage of 400 or 800 gals. per acre, applied at 400 lb. pressure in the control of the disease. From the limited results as yet available, the fungicide would appear to fulfil its main object of reducing teleutospore inoculum sufficiently to preclude the formation of appreciable numbers of aecidial pustules. For instance, the numbers of stalks in 50 hills (representing some 300 stalks) bearing aecidia on 30th June following treatments with 800 gals. 1 per cent. elgetol on the previous 5th December and 27th March were 1 and 4, respectively, compared with 68 in the control plots. In another series, in which the old plants were cut off and burnt prior to spraying, the March treatments with 2, 1, 1, and 0·5 per cent. elgetol at dosages of 800, 800, 400, and 400 gals., respectively, reduced the incidence of rust to 8, 7, 8, and 2 aecidia-bearing stalks, respectively, the corresponding figures for two rows cut, burned, and sprayed in December with 2 and 1 per cent. elgetol (both 800 gals.) being 22 and 12, respectively, Since the practice of burning off the beds, besides being ineffectual in destroying all the inoculum prevents the accumulation of humus in the soil, progressive growers should make use of an eradicant spray, which obviates the need for burning, pending the development of truly resistant strains of the Washington varieties. Treatment may be confined to young beds not intended for harvesting the following spring and under these conditions the cost is not excessive.

STUBBS (L. L.). **Ascochyta blight of field and garden Peas.**—*J. Dep. Agric. Vict.* xl, 5, pp. 260–262, 3 figs., 1942.

Blight due to *Mycosphaerella pinodes* [*R.A.M.*, xxi, p. 185] is stated to be a major disease of field and garden peas in Victoria, where this fungus predominates in the causation of the disease over *Ascochyta pinodella* and *A. pisi*. In a dry season, the planting of seed infected by *M. pinodes* may not necessarily produce a badly diseased crop, but under wet conditions 100 per cent. infection may result, with heavy losses in stand and yield. Further, winter sowings are almost always attacked, though late spring sowings frequently remain healthy. The disease is thus a potential menace almost completely dependent for optimum pathogenicity upon high atmospheric and soil moisture and, possibly, upon low temperature conditions.

The use of clean seed on land not planted to peas for four or five years previously almost excludes the possibility of infection. Most commercial samples of field and garden peas sold in Victoria appear to be infected with at least one of the three blight organisms. Growers in areas where the annual rainfall reaches 25 in. or more should refrain from saving their own seed, unless they are certain that their crops are quite clean. Growers are also advised to practise a rotation that includes peas not more often than once in three years; where conditions allow, the rotation should be extended to four or five years. Sowings should be made late rather than early in areas with sufficient rain in spring and summer. Diseased crop refuse should be destroyed by burning or ploughing under the soil. Seed treatments are not recommended.

GILBERT (W. W.) & DOOLITTLE (S. P.). **Diseases and their control. *Ex* Cucumber growing.**—*Fmrs' Bull. U.S. Dep. Agric.* 1563, pp. 16–22, 4 figs., 1942.

In this bulletin, which supersedes No. 254 in the same series, popular notes are given on several well-known cucumber diseases and their control. Resistance to mosaic has been shown by the Shamrock variety, originating at the Iowa Agricultural Experiment Station.

STIER (H. L.). **Are some of our Cantaloupe troubles caused by nutrient deficiences rather than by diseases?**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 88–90, 1942.

A brief description is given of nutrient deficiency symptoms observed in cantaloupe plants grown in pots and supplied with nutrient solutions lacking in one of the following: nitrogen, phosphorus, potassium, calcium, magnesium, boron, manganese, sulphur, and iron.

STODDARD (D. L.). **Fusarium wilt of Cantaloupe and studies on the relation of potassium and nitrogen supply to susceptibility.**—*Trans. Peninsula hort. Soc.*, xxxi, 4, pp. 91–93, 1942.

Wilt due to *Fusarium bulbigenum* var. *niveum* f. 2 [*R.A.M.*, xviii, p. 368] is stated to constitute a serious menace to the cantaloupe industry in Maryland. It was found for the first time in the State about five years ago, and at present threatens the extinction of much of the area planted to cantaloupes in Anne Arundel County, where last summer the losses in some fields amounted to 100 per cent. On the Eastern Shore the situation is less serious. Losses range from 20 to 50 per cent. in several fields near Preston.

Preliminary studies indicated that the fungus grows best when supplied with nitrogen as nitrate, and that the incidence of the disease is reduced by high potash-containing fertilizers and lime. To ascertain the effect of maintaining a high potassium level, an experiment was carried out with five levels of nitrate (100, 275, 447, 620, and 744 p.p.m.) and four of potassium (78, 117, 156, and 195 p.p.m.). Magnesium, calcium, and phosphate were held constant at 48, 160, and 190 p.p.m., respectively. The plants were grown in white sand in crocks and were inoculated with a suspension

of the fungus by pouring inoculum into holes drilled in the sand to such a depth as to ensure bruising the roots. The results showed conclusively that there is a ratio of potassium to nitrate at which infection can be reduced. For example, deaths from wilt after 20 days were only 1 with 195 p.p.m. potassium and 100 p.p.m. nitrate, 2 when the corresponding figures were 195 and 275 or 447, but 7 when they were 195 and 620 or 744, and 8 when they were 78 and 620. Further tests are to be made. One grower used a 5–8–12 instead of a 6–6–5 fertilizer on badly infected land, and was able to harvest the crown set of melons before the plants were severely affected.

HUMPHREY (N.). **A note on Groundnut selection work.**—*E. Afr. agric. J.*, vii, 4, pp. 220–221, 1942.

By means of continuous selection at the Coast Experiment Station, Kibarani, Kenya, it has been possible to maintain the resistance of groundnuts to *Fusarium* wilt [*R.A.M.*, xix, p. 62] at a sufficiently high level for economic cultivation by the natives, who have already obtained yields of over 1,000 lb. unshelled nuts per acre. The percentages of infection in progeny rows for the years 1937, 1938, 1939, and 1940 were 25·5, 9·5, 6·1, and 9·7, respectively.

ZILLIG (H.) & NIEMEYER (L.). **Wie spart man Kupfer bei der Plasmoparabekämpfung?** [How can copper consumption in *Plasmopara* control be reduced?]—*Wein u. Rebe*, xxiv, 2, pp. 25–47, 1942. [Abs. in *Chem. Zbl.*, cxiii (i), 23, pp. 2921–2922, 1942.]

Particulars are given of experiments at the viticultural branch of the Biological Institute, Bernkastel-Kues on the Moselle, to determine the possibility of economizing in copper consumption in the control of downy mildew (*Plasmopara viticola*) [*R.A.M.*, xxi, p. 402], in which connexion it is stated that the normal German requirement of copper sulphate for this purpose amounts to 24,000 tons for the treatment of an area of 150,000 ha. with a 1 per cent. solution. The replacement of copper by more readily available metals was found to be impracticable. Among the non-metallic preparations tested, PF 89 (Schering A. G.) proved equally effective with Bordeaux mixture, but at some seven times the cost of the latter. Good results were also obtained with preparation 122 (same firm), which was further useful as an insecticide. Five years' trials demonstrated the feasibility and safety of a reduction of the standard copper concentration of between 1 and 1·5 to between 0·5 and 1 per cent. Copper oxychloride solutions, which exert practically no deleterious effect on the growth of the host, are of some value as pre-blossom sprays [ibid., xxi, p. 279], but cannot be substituted for copper sulphate in the rest of the schedule, since even at a strength of 1 per cent. and a copper of 15 to 18 per cent. they are not equivalent to 0·5 per cent. Bordeaux mixture with a 12·5 per cent. copper content.

DENNIS (R. W. G.) & FOISTER (C. E.). **List of diseases of economic plants recorded in Scotland.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 266–306, 1 map, 1942.

This list of diseases of economic plants in Scotland incorporates additional records that have accumulated since the publication of Alcock and Foister's list in 1931 [*R.A.M.*, xi, p. 222]. The known geographical distribution of the diseases is indicated in relation to the main drainage areas, which are shown on a map, and those diseases whose presence in Scotland has been verified by either of the authors are marked with an asterisk.

In an introductory statement, readers are informed that Scotland remains relatively free from a number of destructive diseases prevalent in England. Thus, to quote a few examples, *Rosellinia necatrix* has not been reported, *Helicobasidium purpureum* is very rare, and rots due to *Sclerotinia sclerotiorum* are far from common. On cereals, *Puccinia triticina*, *Ophiobolus graminis*, *Septoria tritici*, *Dilophospora alopecuri*, and *Rhynchosporium secalis* are either unknown or very rare. Asparagus rust (*P. asparagi*)

appears to have been extinct since discovered by Greville at Edinburgh in 1824. Elm disease (*Ceratostomella ulmi*) has failed to establish itself. On the other hand, antirrhinum rust (*P. antirrhini*), first recorded in England in 1933, was found in 1935, and has since been observed in numerous localities.

KAMAT (M. N.). **Progress of plant pathological research in Bombay.**—*Poona agric. Coll. Mag.*, xxxiii, 3, pp. 97–100, 1941.

Reference has already been made in this *Review* to most of the phytopathological problems on which the staff of the plant pathology section of the Bombay Department of Agriculture has been engaged for the last 15 years, but attention may be directed to the following item in this brief survey of the work accomplished. Recent experiments in connexion with the development of resistance to banana wilt [*Fusarium oxysporum* var. *cubense*] showed the highly resistant and commercially superior Basrai variety to be eminently suitable as a substitute for the susceptible Son in the Poona district [*R.A.M.*, xix, p. 641].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liii, 5, pp. 239–242, 4 figs., 1942.

Detailed directions are given for the preparation of Bordeaux mixture.

Lettuce drop (*Sclerotinia* [*sclerotiorum*]) causes heavy losses during the cool part of the year in coastal parts of New South Wales. If the disease appears for the first time in any district and not many plants are affected, an attempt may be made to eradicate it immediately, by removing and burning all diseased plants, with the sclerotia attached to them. The fungus also causes much damage in some years to citrus trees [*R.A.M.*, xv, p. 213] and passion vines [*Passiflora edulis*]. On the former, it causes blighting of twigs or even of large limbs in late winter or early spring; it may also produce a gumming of the collar-rot type at the base of the trunk, and in some years is responsible for a severe nursery blight. Affected parts should be removed and burned during pruning. On passion vines the fungus causes shoot blight and collar rot. In these cases also, the affected parts should be removed and burned.

Citrus growers whose trees have been treated against *Armillaria* [*mellea*] should regularly inspect the excavations round the crown roots to make sure that they have not become filled up, through washing in of soil and rubbish. On no account should weeds be allowed to grow round the butts of treated trees.

Fifty-second and fifty-third Annual Reports of the Tennessee Agricultural Experiment Station, 1939 and 1940.—79 pp., 8 figs., 2 maps, 1940; 109 pp., 29 figs., 4 graphs, 1 map, 1941. [Received July, 1942.]

Among the items of phytopathological interest in various sections of these reports may be mentioned the following. In further regional studies by C. D. Sherbakoff in co-operation with the United States Department of Agriculture on cotton wilt (*Fusarium*) [*vasinfectum*], the Dixie Triumph 12 and Clevewilt 6 varieties showed complete resistance to the disease over a three-year period, whereas Miller 610 and Rowden 2088 were dependable in this respect only where infection was mild and a balanced fertilizer, including sufficient potash, had been applied; Coker 100 and Half and Half sustained severe injury even from slight attacks of the fungus [*R.A.M.*, xxi, pp. 74, 197].

Very promising results in regard to resistance to wilt [*F. bulbigenum* var. *niveum*] were obtained in tests on severely infested soil with the Hawkesbury watermelon [ibid., xvii, p. 298; xviii, p. 368].

None of the 180 tomato selections tested in 1940 for resistance to leaf spot or blight (*Alternaria solani*) was found to possess true resistance.

Eradicant sprays, consisting of Bordeaux mixture plus calcium and zinc arsenates, and in one case elgetol [ibid., xxi, p. 383], were no more effective in experiments car-

ried out by R. A. Hyre and J. O Andes against bitter rot [*Glomerella cingulata*] of apples than the standard Bordeaux mixture at normal or half strength. Eradicant treatment was successful in the control of blotch [*Phyllosticta solitaria*], but not to the same extent as the summer sprays of Tennessee '34' copper. Yellow cuprocide (1½ lb. per 100 gals.) caused severe injury to Golden Delicious apples, while the damage inflicted by two neutral Bordeaux mixtures was only slightly less than that due to the standard 8–12–100 formula on this variety.

Seedling pear selections from crosses containing a quarter of *Pyrus serotina* were found by B. D. Drain, A. B. Strand, and D. M. Bailey to combine a high degree of resistance to fire blight [*Erwinia amylovora*] with suitable commercial characteristics.

Fifty-eighth Annual Report for year ended June 30, 1941, Agricultural Experiment Station, Wisconsin. Part II (*Bull.* 455).—87 pp., 29 figs., 2 graphs, 1942.

This report [cf. *R.A.M.*, xx, p. 518] contains the following items of interest. Seed of the Vicland oat variety, resistant to stem rust [*Puccinia graminis*], leaf rust [*P. coronata*], and smuts [*Ustilago avenae* and *U. kolleri*], was placed on the market in Wisconsin for the first time in 1942. This variety is regarded as superior to Vanguard [ibid., xix, p. 83], which is susceptible to leaf rust and smut, and while on an average Vanguard during the past five years has yielded only 2 per cent. more than State's Pride, Vicland has yielded 34 per cent. more. It is, however, the shortest-strawed of all Wisconsin oat varieties, and is handicapped on poor, sandy soil. It gives less trouble from lodging than any other variety grown in the State, and is suitable for highly fertile or moist soils where most varieties would be practically certain to go down.

'Deep' or 'pitted' scab of potatoes, which appears to be a combination of ordinary scab [*Actinomyces scabies*] and infestation by the scab gnat [*Pnyxia scabiei*: cf. ibid., xxi, p. 266], is becoming more troublesome. The maggot form of the insect attacks potatoes at points where the skin has been broken by scab, and feeds on the tissue in the scab spot until moderately deep wounds are produced. The maggots attack both seed pieces and growing tubers, and may continue to feed on stored potatoes. No entirely satisfactory method of control is at present known, apart from the use of scab-resistant varieties.

Sebago and Pontiac are now added to those potato varieties (chiefly Chippewa and Triumph) which do not tend to turn black when cooked [ibid., xxi, p. 41]. Apparently the tendency to 'cook white' is an inherited trait. On the basis of a 'blackening index', in which 0 = perfectly white and 100 = dark grey, varieties tested over five years rank as follows: Triumph 20, Chippewa 21, Houma 27, Katahdin 29, Red Warba 30, Irish Cobbler 37, Green Mountain 38, Rural New Yorker 45, and Russet Rural 49.

Triumph and Cobbler potatoes growing on burned peat soil showed a condition in which the new leaves were yellowish and later showed pin-point spots and stunting. Some of the plants wilted and died, while others grew slowly and produced small tubers. The application of 12 lb. manganese sulphate per acre in a 1 per cent. spray at four 10-day intervals kept the potatoes green until August [cf. ibid., xxi, p. 92]. Manganese deficiency was clearly involved but apparently there was a deficiency of zinc and possibly of copper also in the part where the peat had burned most thoroughly some years before, because here the use of zinc sulphate and copper sulphate with manganese enabled the potato vines to remain green for two weeks longer than those sprayed with manganese sulphate alone.

Symptoms of potato bacterial ring rot [*Corynebacterium sepedonicum*: ibid., xxi, p. 263], which is stated to be spreading locally, do not always show up in the field in Wisconsin, though they commonly do so farther south. A crop without conspicuous damage at digging may decay badly in storage. When foliage injury does develop in Wisconsin, it generally appears after blossoming. Some of the younger leaflets lose their firmness, begin to wilt, and roll slightly inwards and upwards towards the

midrib. A slight mottling may appear as the leaflets turn pale green to yellow. Finally, the rolled leaf edges dry out and shrivel. The entire plant may droop and wilt from the top downwards. The only method of control is to plant clean seed.

Indirect evidence indicates that the Sebago potato variety is resistant to yellow dwarf [ibid., xxi, p. 264].

Squash [*Cucurbita* sp.] wilt [*Fusarium bulbigenum* var. *niveum*] has in recent years caused damage in the south-eastern, central, and west-central areas of Wisconsin, the losses in some cases reaching 90 per cent. of the crop. At present, the only method of control is to plant the resistant Fable Queen variety. Watermelon varieties showing a valuable degree of resistance to the fungus in Wisconsin are Leesburg, Klondike No. 7, Hawkesbury, Improved Kleckley No. 6, and Stone Mountain No. 5.

Garden and sugar beets growing on boron-deficient soil derived marked benefit from borax sprays and dusts applied at midsummer [ibid., xxi, p. 114]. Preliminary tests indicated that summer applications alone, if made before the deficiency symptoms become apparent, may prove to be sufficient to control the disorder. Borax spraying or dusting is recommended in those fields where a soil application at seeding is insufficient. In a test field to which 50 lb. of borax per acre was applied at seeding, beets showing black spot in mid-July were sprayed on 22nd July, before root symptoms appeared, at a rate equivalent to 50 lb. of borax per acre. On 12th August, only 4 per cent. of the sprayed beets were affected, as against 32 per cent. of the unsprayed. Midsummer applications of borax dusts to sugar beets at the rate of 40 lb. per acre completely eliminated heart rot and greatly increased yield.

Investigations on cabbage club root [*Plasmodiophora brassicae*] showed that mustard oil in high enough concentrations prevented germination of the fungus [ibid., xviii, p. 508], while low concentrations stimulated it. Thus, if the oil is liberated from plant roots, it may predispose the plants to infection by hastening the germination of spores in the soil, or possibly by stimulating the growth of the organisms after they penetrate the roots. One type of mustard oil, allyl isothiocyanate, in seven experiments stimulated spore germination when used at concentrations between 1·25 and 50 parts per million; in most cases 40 to 80 p.p.m. were necessary to prevent germination, though in one case 10 p.p.m. sufficed. The other mustard oil, beta phenyl ethyl isothiocyanate was in general more toxic than the allyl type.

Of various fertilizer treatments applied on 28th August to unthrifty celery which had received a side dressing of 500 lbs. of 3–9–18 fertilizer per acre shortly after planting in July, the best was 500 lb. 3–12–12 plus 25 lb. copper sulphate, which increased yields 87 per cent. over the control and 80 per cent. over the part given 3–12–12 without copper. The use of 50 lbs. of borax with the 500 lb. 3–12–12 increased yields by 80 per cent. over the control and 53 per cent. over the plot given 3–12–12 alone. The borax-treated celery was also free from cracked stems [ibid., xx, p. 192], which were noted elsewhere in the field.

Confirmatory evidence has been obtained that yellows of sour cherry in Wisconsin [ibid., xix, p. 30; xx, p. 373] is caused by a virus. The disease can also attack choke-cherry [*Prunus virginiana*] and the Mahaleb cherry, but sweet cherries are not affected. In Door county, the number of affected trees increases by about 3 per cent. each year, to judge from five years' observations on 2,500 trees in five orchards. Nearly 11 per cent. diseased trees were found last year of 6,500 examined in 18 orchards. Yield reduction is severe on trees that have shown symptoms for four or five years. Only disease-free stock should be planted, and all young trees that become affected should be destroyed.

Several years' tests showed that cherry leaf spot [*Coccomyces hiemalis*: ibid., xxi, p. 245] is as well controlled by four applications of Bordeaux mixture 3–4–100 as by three at 6–8–100 concentration. Last year's trials on Montmorency trees showed that Bordeaux mixture (6–8–100) made with high-calcium lime and applied in the three-spray programme (at petal-fall, about two weeks later, and just after harvest) gave

excellent control, but injured the foliage late in the season; it also reduced the size of the fruit by 15 per cent. Bordeaux mixture (3–4–100) in a four-spray programme (i.e., as above, but with a further application about four weeks after petal-fall) gave approximately the same results as three applications at 6–8–100, though in some years the lower concentration reduced the fruit size less than the standard treatment. Four applications of Bordeaux mixture ($1\frac{1}{2}$–2–100) gave satisfactory control on some occasions, with little fruit injury or reduction in size, but this programme was not always effective. The use of high-magnesium instead of high-calcium lime in the various Bordeaux treatments reduced foliage injury without affecting degree of control or fruit size. Basicop plus high-magnesium lime (3–8–100) gave fairly satisfactory control without foliage injury, but reduced fruit size. Cupro-K and high-magnesium lime (3–3–100) plus 1–800 oil failed to give good control. Tennessee copper 34 and high magnesium lime (3–3–100) plus 1–800 orthex controlled leaf spot without foliage injury and gave fruit larger by 10 per cent. than the effective Bordeaux treatments.

Inoculating evergreen seedlings with suitable mycorrhizal fungi, particularly *Boletus felleus*, greatly improved their growth and survival on prairie soil. The evidence obtained indicated that the mycorrhizal fungi rendered the potassium present in the soil more readily available to the seedlings.

Principales enfermedades parasitarias [y] no parasitarias que fueron objeto de consulta en el primer semestre (Enero–Junio) de 1941. [The principal parasitic and non-parasitic diseases which were the object of consultation during the first six months (January to June) of 1941.] *Bol. Sanid. veg., Santiago*, i, 1, pp. 79–83, 1941.

Among the diseases engaging the attention of the phytopathological staff of the Chilean Ministry of Agriculture during the period from January to June, 1941, may be mentioned raspberry anthracnose (*Elsinoe veneta*), *Plectodiscella* [*E.*] *piri* and *Nectria galligena* on apple [*R.A.M.*, xix, p. 366], *Colletotrichum gloeosporioides*, witches' broom, and *Phytophthora citrophthora* on orange, *Coryneum beijerinckii* [*Clasterosporium carpophilum*: ibid., xx, p. 9] on apricot, *Guignardia bidwellii* on vine, *Colletotrichum lindemuthianum* and *Fusarium martii* on French bean (*Phaseolus vulgaris*), *Uromyces fabae* on broad bean, and blossom-end rot of tomato.

Katznelson (H.). **Inhibition of micro-organisms by a toxic substance produced by an aerobic spore-forming bacillus.**—*Canad. J. Res.*, Sect. C, xx, 3, pp. 169–173, 1942.

The bacillus recently shown by Cordon and Haenseler to produce a thermostable toxin active against *Rhizoctonia* [*Corticium*] *solani* [and regarded by them as a rough strain of *Bacillus simplex*: *R.A.M.*, xviii, p. 567] was found by the author to produce a thermostable diffusible substance which inhibited the growth of 77 out of 81 species of fungi. Actinomycetes were more tolerant to it than fungi, though some were completely inhibited. The majority of streptococci, staphylococci, bacilli, lactobacilli, and clostridia tested were suppressed by the toxic medium, but Gram-negative organisms were unaffected. *B. subtilis* and, to some extent, *B. cereus* and *B. pumilus* also produced thermostable substances toxic to *C. solani*.

The toxic substance produced by Cordon and Haenseler's organism was completely adsorbed by soil, bentonite, and activated charcoal, partly by agar, and not at all by talc; it passed through cellophane, parchment, and collodion, resisted autoclaving for 30 to 45 minutes at 15 lb. pressure, but was rapidly destroyed by heating in alkaline (less rapidly in acid) solutions. It was not inactivated by aeration and retained its potency for many months at 0° C. It was not removed from the toxic medium by ether, chloroform, benzene, ethyl acetate, or N butyl alcohol, but was partially eluted from charcoal with 95 per cent. ethyl alcohol.

Stapp (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. IX. Mitteilung. Daphne mezereum L. als weitere neue Wirtspflanze.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note IX. *Daphne mezereum L.* as a further new host plant.]—*Zbl. Bakt.*, Abt. 2, cii, 15–17, pp. 295–300, 1 fig., 1940.

From tumours on naturally infected young *Daphne mezereum* plants from a plant protection station in north-west Germany the writer isolated a strain of *Pseudomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xix, p. 201], which proved to be highly pathogenic to *Pelargonium zonale* and slightly so to *Datura tatula*, while sunflowers and tomatoes reacted negatively to inoculation. The new strain was found to be serologically distinct from the several forms of *Bact. tumefaciens* harboured by *Dahlia variabilis*, *Asparagus sprengeri*, and beans (*Phaseolus vulgaris*), though agreeing with them in morphological and cultural characters, including 'star' formation [ibid., xi, p. 357] in an iron-manganese-carrot juice medium.

Stapp (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. XI. Mitteilung. Zytologische Untersuchungen des bakteriellen Erregers.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note XI. Cytological studies of the bacterial agent.]—*Zbl. Bakt.*, Abt. 2, cv, 1–4, pp. 1–14, 3 pl., 1942.

The results of comparative cytological studies on a number of spore-forming bacteria and *Pseudomonas* [*Bacterium*] *tumefaciens* (strains Ra from dahlia and IIb from *Chrysanthemum frutescens*) showed that individual members of the so-called 'star' or 'rosette' phase in the development of the crown gall pathogen [see preceding abstract] are mostly uni- or bi-, seldom tri- or quadrinucleate. When the rods have fused into a complex, the individuals begin to elongate and thicken, and if a preparation is stained at the critical phase the individual rods of the star complex are found uniformly to contain only one nucleus, at or near the polar end connected with the centre. At a somewhat later stage there are no more individual nuclei but one large central nucleus resulting from the fusion of the individuals participating in the formation of the star. On the dissolution of this central nucleus each individual rod once more acquires a nucleus, the subsequent division of which is followed by subdivision into short swarming rods.

Kelly (C. F.), Stahl (B. M.), Salmon (S. C.), & Black (R. H.). **Wheat storage in experimental farm-type bins.**—*Circ. U. S. Dep. Agric.* 637, 245 pp., 7 figs., 7 diags., 18 graphs, 1 map, 1942.

One of the objects of this comprehensive series of experiments on wheat storage on farms, carried out from 1936 to 1941 in four different States, Maryland, Illinois, Kansas, and North Dakota, was to ascertain the value of fungicidal treatment of the seed-grain before placing it in the bins. A mixture of lime and sulphur (3 or 4 : 5 or 6 parts by weight), at various dosages, e.g., 0·1 lb. per bush., proved to be of some use in postponing the development of abnormal odours, but caused a decrease in weight which in several cases was sufficient to lower the numerical grade of the product. A formalin-water solution (1:1), used at the rate of ½ pint per 22 bush. seed-grain, failed to prolong the safe storage period but caused no reduction in weight. The treatment adversely affected the baking qualities of soft red winter wheat, while those of hard red spring were not impaired.

Baylis (G. T. S.). **Viability of dusted Wheat after storage.**—*N. Z. J. Sci. Tech.*, A, xxiii, 3, pp. 126–130, 1941.

Both agrosan G and ceresan U.T. 1875 A improved the field germination at Lincoln, Canterbury, New Zealand, of Solid Straw Tuscan wheat seed-grain stored under normal conditions at Christchurch for 12 months between the dates of dusting and sowing, both preparations being applied at dosages of 2 and 4 oz. per bush. The moisture contents of the seed samples ranged from 12·8 to 16·7 per cent., and at the

higher proportion injury was sustained by those stored for a year in a closely sealed tin. The average laboratory germination of untreated and ceresan-dusted seed after 14 months was 79 and 83 per cent., respectively, compared with 92 per cent. for treated material stored in sacks. The average field germination after one year's storage in sacks of untreated seed-grain with moisture contents of 16·7, 15·9, 15·4, 15, 14·1, 13·2, and 12·8 per cent., respectively, amounted to 67, 75·5, 69, 74, 80, 81·5, and 82·5 per cent., respectively, the corresponding figures for the dusted samples (average of all treatments) being 70·6, 76·8, 81·3, 86, 86, 85·8, and 88·1 per cent., respectively.

Stumbo (C. R.), Gainey (P. L.), & Clark (F. E.). **Microbiological and nutritional factors in the take-all disease of Wheat.**—*J. agric. Res.*, lxiv, 11, pp. 653–665, 4 figs., 1942.

In the course of studies on the take-all (*Ophiobolus graminis*) disease of wheat [*R.A.M.*, xxi, p. 133] it was found that no differences exist in either the number or kind of micro-organisms in infested and non-infested field areas of the silt loam and clay loam prairie soils tested. There appeared to be no correlation between the level of available phosphorus and the incidence of disease. In pot experiments in the greenhouse, using Kanred wheat, the addition at planting time of ground wheat straw to naturally infested soil resulted in a significant increase of soil micro-population for several months, and even the heaviest doses of inorganic fertilizers failed to maintain the available phosphorus and nitrate nitrogen content at a satisfactory level throughout the growing season; all plants proved to be badly diseased at maturity. The application at sowing time of adequate supplies of either available phosphorus (as superphosphate) or nitrate nitrogen (slightly in excess of the amount calculated as necessary for plant growth) alone appeared to effect no appreciable reduction in the severity of the disease, but when both were applied, the severity was reduced by increasing rates of superphosphate. Successful control of *O. graminis* was obtained in pots (with three plants in each) receiving 200 p.p.m. of phosphorus as superphosphate at planting time and 224 mg. nitrogen per plant added as ammonium nitrate in 60 applications of 4 p.p.m. nitrogen each during the growing season. These results indicate that nutritional factors are extremely important in determining the severity of take-all disease.

Fulling (E. H.). **Plant life and the law of man. III. Barberry eradication.**—*J. N.Y. bot. Gdn*, xliii, 510, pp. 152–157, 1942.

This is an outline of the gradual recognition of the part played by the barberry in the dissemination of wheat rust [*Puccinia graminis*], and of the legislative measures adopted to eliminate this carrier of infection in various European countries [*R.A.M.*, ii, p. 499] and the United States [ibid., xviii, p. 165; xix, p. 395, *et passim*], where Connecticut was the pioneer among the States in this direction, its first eradication law having been passed in 1726. Towards the end of the colonial period, however, the initial American attempts to combat the wheat rust by the extirpation of its alternate host were gradually abandoned, only to be resumed on a firmer basis of scientific knowledge during and after the first quarter of the twentieth century.

Suneson (C. A.) & Houston (B. R.). **Male-sterile Barley for study of floral infection.**—*Phytopathology*, xxxii, 5, pp. 431–432, 1942.

Male-sterile barley, which it has been suggested may be of service to plant breeders (*J. Hered.*, xxxi, pp. 213–214, 1940), appears likely to provide a means of mass inoculation of barley flowers with cultures of disease-producing fungi transmitted by floral infection. At Davis, California, male-sterile barley spikes were inoculated with spores of *Helminthosporium gramineum* and *Ustilago nuda*, the former fairly prevalent and the latter seldom persistent under local conditions. In the stripe disease tests,

the spikes were first pollinated by mass dusting with pollen from F_1 hybrids heterozygous for the male-sterile factor. Leaves from plants killed by the fungus were next pulled from the top of the spike downwards between each row of glumes to facilitate discharge of the spores into the open florets, and the inoculated spikes were then bagged. The percentage of infection ranged from 70 to 89·5 per cent., which is approximately equal to that obtained by the culture of sprouting barley on a substratum supporting mycelial growth of *H. gramineum*. In the case of *U. nuda*, mass dusting with both pollen and smut spores was requisite, but only a low incidence of infection (0 to 31·6 per cent.) was obtained, possibly due to varietal resistance, low atmospheric humidity at the time of inoculation, or poor viability of the spores [*R.A.M.*, xx, p. 296].

Reed (G. M.). **Reports on research for 1941. Plant pathology.**—*Rep. Brooklyn bot. Gdn, 1941* (*Brooklyn bot. Gdn Rec.*, xxxi, 2), pp. 90–94, 1942.

The outstanding feature of the 1941 investigations on oats smuts [cf. *R.A.M.*, xx, p. 392] was the detection of a new specialized race of loose smut [*Ustilago avenae*] pathogenic to Victoria and many of the hybrid selections of which it is one of the parents [ibid., xxi, p. 251].

The results of further studies conducted on three hybrids with the Navarro variety of oats, noted for its high degree of resistance to *U. avenae* and covered smut [*U. kolleri*], as one of the parents have already been noted from another source [ibid., xxi, p. 367].

In a series of xperiments by Jeanne P. Walther to determine the effects of inoculation with *U. avenae* and *U. kolleri* on resistant and susceptible oats varieties, the treated seedlings generally showed a reduced rate of emergence as compared with the uninoculated. Varieties inoculated with races of *U. kolleri* to which they were susceptible were not appreciably delayed in their development, whereas a marked retardation followed the treatment of the same varieties with less pathogenic races. Similar responses were observed among the varieties to inoculation with *U. avenae*. Some varieties susceptible to both smuts made abnormally slow growth after inoculation but appeared to be stimulated to some extent by infection with races to which they were resistant.

In further studies by L. G. Utter on the effects on Gothland, Monarch, and six other oats varieties of 40 collections of smut originating from the hybridization of race 1 of *U. avenae* and race 1 of *U. kolleri*, 24 resembled the latter in symptomatology and morphology and 16 the former. Combining the infection data of 1941 with those obtained from 1938 to 1940, it was possible to separate 13 races of *U. kolleri* on the eight test varieties, most of which were resistant to race 1, while displaying variable reactions to the new races. Similar results were secured with nine races of *U. avenae* on six varieties, all of which, except Monarch, were susceptible to race 1 while differing in their responses to the other races used in the tests.

Hagborg (W. A. F.). **Classification revision in Xanthomonas translucens.**—*Canad. J. Res.*, Sect. C, xx, 5, pp. 312–326, 1942.

Referring to the long-apparent need for a revision of the classification of *Phytomonas translucens*, the author points out that in 1917, Jones, Johnson, and Reddy described the species as *Bacterium translucens*, the organism causing bacterial blight of barley. Two years later, Smith, Jones, and Reddy described a variety, *Bact. translucens* var. *undulosum*, which resembled the original species, but attacked wheat, barley, and rye. In 1924, Reddy, Godkin, and Johnson described a second variety, *Bact. translucens* var. *secalis*, attacking rye only [*R.A.M.*, iv, p. 160]. In 1936, Hagborg transferred *Bact. translucens* var. *undulosum* to *Phytomonas* and changed its rank to forma specialis [ibid., xvi, p. 91]. In 1939, Dowson transferred the original species to *Xanthomonas* as *X. translucens* [ibid., xviii, p. 658]. In the present paper the author reports the discovery of two further forms of the same species showing specialized

parasitism. He accepts the genus *Xanthomonas*, but emends the description of *X. translucens* to include all the derivatives, which are described as five formae speciales of the emended species.

The emended determinative description of *X. translucens* is as follows: straight rods, not producing endospores, motile by a single polar flagellum; growth on peptone beef agar yellow after four days; gelatine liquefied, nitrites not produced from nitrates, pathogenic on one or more genera of Gramineae; known to consist of several formae speciales.

The two new formae speciales, unlike any of the forms reported hitherto, are both capable of causing water-soaked lesions on oats seedlings after artificial inoculation, which may be made with or without wounding. They are straight, yellow rods, motile by means of a single polar flagellum; they do not produce endospores, they liquefy gelatine, and they are unable to reduce nitrates to nitrites. One of them can infect barley and oats but not wheat and rye, and is named *X. translucens* f. sp. *hordei-avenae*; the other infects wheat, oats, barley, and rye, and is named *X. translucens* f. sp. *cerealis*.

The determinative descriptions of the five known special forms are as follows. (1) *X. translucens* f. sp. *hordei* f. sp. nov. (synonyms: *Bact. translucens* Jones, Johnson, & Reddy, 1917, *sensu stricto*, *Pseudomonas translucens* Stapp, 1928, *Phytomonas translucens* Bergey *et al.*, 1930 and *X. translucens* Dowson, 1939) occurs naturally on *Hordeum* spp.; produces water-soaked infections following wound inoculation at 25° to 30° C. in seedlings of *Hordeum* spp. but not of *Triticum* spp., *Avenae* spp., or *Secale cereale*. (2) *X. translucens* f. sp. *undulosa* (S., J., & R.) comb. nov. (synonyms: *Bact. translucens* var. *undulosum* Smith, Jones, & Reddy, 1919, *Pseudomonas translucens* var. *undulosa* Stapp, 1928, and *Phytomonas translucens* f. sp. *undulosa* Hagborg, 1936) occurs naturally on *Triticum* spp. and on *Secale cereale*; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *Triticum* spp., *Hordeum* spp., and *S. cereale*, but not of *Avena* spp. (3) *X. translucens* f. sp. *secalis* (R., G., & J.) comb. nov. (synonyms: *Bact. translucens* var. *secalis* Reddy, Godkin, & Johnson, 1924, *Pseudomonas translucens* var. *secalis* Stapp, 1928, and *Phytomonas translucens* var. *secalis* Bergey *et al.*, 1939) occurs naturally on *S. cereale*; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *S. cereale*, but not of *Triticum* spp., *Hordeum* spp., or *Avena* spp. (4) *X. translucens* f. sp. *hordei-avenae* f. sp. nov. occurs naturally on *Hordeum* spp.; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *Hordeum* spp., and *Avena* spp., but not of *Triticum* spp. or of *S. cereale*. (5) *X. translucens* f. sp. *cerealis* f. sp. nov. occurs naturally on *Triticum* spp.; produces water-soaked infections following wound inoculation at 25° to 30° in seedlings of *Triticum* spp., *Hordeum* spp., *Avena* spp., and *S. cereale*.

The non-determinative cultural characters of 13 pure cultures of *X. translucens* emend. of monocolonial origin, which had been isolated from various cereals and found to be pathogenic on one or more of them, were studied in detail. The 13 test cultures belonged to *X. translucens* f. sp. *undulosa*, f. sp. *hordei-avenae*, and *X. translucens* f. sp. *cerealis*; for comparative purposes, check cultures of *Pseudomonas atrofaciens*, *P. coronafaciens*, and *P. radicicola* var. *phaseoli* were included in the studies. The results were as follows. All the test but none of the check cultures produced hydrogen sulphide. All cultures, both test and check, produced ammonia in peptone beef broth. No test culture produced a water-soluble green, blue, or pigment. Litmus milk was decomposed by the test cultures only. In general, the test cultures were able to digest dextrose, *d*-levulose, *d*-mannose, *d*-galactose, sucrose, lactose, and salicin, but not *l*-rhamnose, inosite, maltose, raffinose, inulin, dextrin, mannitol, and dulcitol. *X. translucens* was found to be capable of digesting starch, but only in the presence of a basal medium that in itself permits good growth; the organism is weak in diastatic enzymes. No correlation was found between any cultural character in the different forms of *X. translucens* and pathogenicity. Differences in pathogenic

capabilities occurred between different isolates of the same forma specialis, suggesting that it may become necessary to recognize different races within the special forms.

Stringfield (G. H.) & Bowman (D. H.). **Breeding Corn hybrids for smut resistance.** —*J. Amer. Soc. Agron.*, xxxiv, 5, pp. 486–494, 3 graphs, 1942.

Smut (*Ustilago zeae*) counts made in 48 maize performance experiments in 13 counties of Ohio from 1933 to 1938 indicated that some three-quarters of the hybrid entries carried less infection than the open-pollinated varieties [cf. *R.A.M.*, x, p. 723], Woodburn, Cook, Medina Pride, Waugh, and Clarage. Twelve inbred lines appeared to be more or less resistant to the disease, viz., Ohio 02, 10, 15–6, 26, 51, 56, 66, 84, 306 A, and 601 S, C. I. 4–8, and Iowa L 317, and hybrids in which half or more of the parentage consisted of these strains showed less than a third as much smut as the open-pollinated varieties. Some of these hybrids combine resistance to smut with other desirable commercial qualities, and their extensive cultivation and that of similar lines in other States constitutes the first significant advance in the control of the disease.

Richardson (J. K.). **Studies on root rot of Corn in Ontario.**—*Canad. J. Res.*, Sect. C, xx, 4, pp. 241–256, 1 pl., 15 figs., 1942.

In laboratory and greenhouse studies of maize root rot [*R.A.M.*, xx, p. 344] in Ontario, isolations from small roots of maize plants grown in unsterilized, root-rot-infested soil and greenhouse compost yielded a number of organisms, of which the following six were proved by inoculation to be parasitic: a *Pythium* sp. believed to be *P. arrhenomanes*, *P. de Baryanum*, *Helminthosporium bicolor*, *H. maydis*, and two species of *Fusarium*. *P. arrhenomanes* and both *H.* spp. caused a reduction in the germination of maize seed of 40 to 50 and 5 to 10 per cent., respectively; and maize plants grown in sterilized soil, to which these fungi were added, remained 5 to 8 in. high after 24 days of growth whereas those grown in soil inoculated with *P. de Baryanum* and *F.* spp. were 8 to 11 in. and 12 to 14 in. high, respectively.

The results of cover-crop experiments showed conclusively that the condition of a maize crop growing in root-rot-infested soil is influenced materially by the preceding cover crop. Thus, following soy-beans the roots of maize were perfectly healthy, while following timothy [*Phleum pratense*] the reduction in growth and the diseased condition of the roots was even more severe than when maize followed maize. The other cover crops tested had an intermediate effect. In rotation, the best results were obtained when soy-beans immediately preceded maize, even when they followed upon timothy. Since the roots of soy-beans grown in artificially infected soil were found to be as susceptible to root-rot fungi as those of timothy, these results are taken to indicate that some factor other than parasitism must be involved in the effects derived from the various crops tested.

When species of *Pythium*, *Helminthosporium*, and *Fusarium* isolated from maize roots were inoculated into soil under controlled conditions at temperatures ranging from 9° to 29° C., it was found that at all but the lowest temperatures (9° to 11°) high soil moisture increased the growth of maize perceptibly over that of maize kept at lower moisture level. The lower ranges of temperature were generally found to favour the development of pathogens causing the most severe damage. *Pythium* spp. proved to be the most strongly pathogenic, causing an extreme reduction in growth of the host even at the highest temperatures, which are the optimal for the development of the host, and being also probably responsible for pre-emergence killing of seedlings. The general effect of *Helminthosporium* spp. was similar to, but less severe than that produced by *Pythium* spp., causing no appreciable pre-emergence killing except at the lowest temperatures. *Fusarium* spp. caused hardly any reduction in germination and only a slight reduction in growth of maize.

The type of injury to the plant varied with the parasite. Infection by *Pythium* spp.

affected all roots (but not the mesocotyl, unless the seed was destroyed), usually commencing at the apex and progressing rapidly as a light-coloured, watery soft rot, destroying first the cortical tissues and later the vascular system. Infection by *Helminthosporium* spp. gave the roots a dark brown or black and leathery appearance; it usually affected the scutellum and endosperm as well as the mesocotyl and most of the radicles and crown roots, frequently spreading upwards into the coleoptile and older leaves; beyond the infected areas the roots appeared to function quite normally. Infection by *Fusarium* spp. was considerably less serious, causing destruction of many laterals and the appearance of occasional brown lesions on the larger roots; in contrast to the fungi of the other two genera, it was favoured by high temperature combined with low soil moisture content, and was practically negligible at the lower ranges.

Elliott (Charlotte). **Relative susceptibility to Pythium root rot of twelve Dent Corn inbreds.**—*J. agric. Res.*, lxiv, 12, pp. 711-723, 5 figs., 3 graphs, 1942.

In inoculation experiments, carried out during 1940 and 1941 in the greenhouse at the Arlington Experimental Farm, Virginia, 12 inbred lines of Dent maize grown in sand and watered with nutrient solution were tested for resistance to *Pythium arrhenomanes* [*R.A.M.*, xiv, p. 94]. In both years the inbred Ia. L317 was the most resistant and C.I.1 the most susceptible of all. Thus the mean increase in height of control Ia. L317 plants was higher by 19 per cent. in 1940 and 34·4 per cent. in 1941 than that of inoculated ones, while the corresponding differences for C.I.1 plants were 77·8 and 77·4 per cent.; the green weight of the tops of control plants was higher by 11·1 and 58·1 per cent. than that of inoculated ones for Ia. L317 and by 96·5 and 94·5 per cent. for C.I.1; and finally, the weight of roots by 24 and 58·6 per cent. for Ia. L317 and 92·8 and 91·3 per cent. for C.I.1. The other lines tested occupied an intermediate position with regard to susceptibility. All inbreds were to some extent affected by the fungus, which destroyed the fine feeding roots.

Rhoads (A. S.). **The successful transmission of psorosis of Citrus trees in Florida by bark grafting.**—*Phytopathology*, xxxii, 5, pp. 410-413, 1 fig., 1942.

Particulars are given of the writer's successful experiments in Florida in the transmission of psorosis from diseased to healthy 28-year-old orange trees by means of patch bark inoculations, using pieces of diseased bark ¾ in. square, the typical bark symptoms appearing in six out of twelve cases after a three-year incubation period and making very little further progress during the next three years. These results substantiate those of Miss Doidge and Turner in the transmission of psorosis in South Africa [*R.A.M.*, xix, p. 86] and confirm H. S. Fawcett's demonstration of the agent as a virus [ibid., xviii, p. 248].

Dastur (R. H.). **How 'tirak' affects Punjab-American Cottons.**—*Indian Fmg*, iii, 4, pp. 181-183, 2 pl., 1942.

'Tirak', meaning 'bad opening of the bolls', is a physiological disorder of Punjab-American cottons characterized by foliar chlorosis, followed by reddening and shedding of the leaves and ultimately by the premature cracking of the abnormally small bolls, which contain only unripe seeds, poor-quality lint, and a low percentage of oil. In 1921, 1926, and 1928, when the trouble assumed a very intense form, the average yield for the Punjab of 5·2 maunds [1 maund = 82·284 lb.] per acre was reduced to 3, a serious consideration in view of the wide area (fluctuating from 1,000,000 to 1,500,000 acres from season to season) under cotton. In 1939, therefore, investigations on the etiology and control of the disease were commenced under the joint auspices of the Punjab Government and the Indian Central Cotton Committee and are still in progress.

Tirak is prevalent both on light sandy soils deficient in nitrogen and on sandy loams with abnormally large quantities of sodium salts in the upper subsoil. In the former class the nitrogen content of the foliage in September was shown by chemical analysis not to exceed 1·5 per cent. instead of the normal 2·5; at the same time accumulation of tannin in the leaves was giving rise to metabolic disorders. Foliar wilting and shedding and scantiness of boll production are more immediately associated with salinity of the subsoil, which interferes with the absorption of water by the roots and is actually toxic to the rootlets. Prolonged warm, dry spells in September and October tend to promote abnormally heavy losses of water even in normal non-saline soils, and the delay or omission of irrigation under such conditions may be attended by serious consequences.

Vasudeva (R. S.). **Studies on the root-rot disease of Cotton in the Punjab, XI. Effect of mixed cropping on the incidence of the disease.**—*Indian J. agric. Sci.*, xi, 6, pp. 879–891, 2 pl., 2 graphs, 1941.

In further studies at the Lyallpur (Punjab) Agricultural Research Institute, supplemented by confirmatory trials at the British Cotton Growing Association Farm, Khanewal, on root rot of cotton (*Macrophomina phaseoli* and *Corticium solani*) [*R.A.M.*, xxi, p. 76], the incidence of infection was significantly reduced by intercropping the *Gossypium indicum* variety Mollisoni 39 with J. 20 sorghum, the best results (3 per cent. as compared with 69 in the control plots) being secured by the removal of the sorghum on 16th August, both crops having been sown on 16th May, 1939. The corresponding figures for the plots from which the sorghum was removed on 20th and 30th July and 10th August were 24, 19, and 20 per cent., respectively. Soil and air temperatures were lower and humidity higher in the mixed than in the pure cotton plots. Two American cotton (*G. hirsutum*) varieties, LSS and KT 25, interplanted with *Phaseolus aconitifolius*, gave higher yields than pure stands, the incidence of infection being reduced from 63 to 1 per cent. in the former and from 46 to 3 per cent. in the latter variety. Indian cotton likewise responded favourably to an admixture of *P. aconitifolius*, the amounts of root rot at Lyallpur in the pure and mixed plots being 55 and 2, and at Khanewal 52 and 2 per cent., respectively. *P. aconitifolius* may be withdrawn from the plots by 1st August. Interplanting with *Panicum colonum* and *Setaria italica*, especially the former, also tended to improve the health of Mollisoni 39.

Tisdale (H. B.) & Dick (J. B.). **Cotton wilt in Alabama as affected by potash supplements and as related to varietal behaviour and other important agronomic problems.**—*J. Amer. Soc. Agron.*, xxxiv, 5, pp. 405–426, 1 fig., 2 graphs, 1942.

The average incidence of cotton wilt (*Fusarium vasinfectum*) at various localities in Alabama in which experiments were conducted for three years and upwards ranged from 45 to 83 per cent. in the highly susceptible variety, Half and Half, and from 9 to 56 in the weakly tolerant group, including Cook 1138, Rowden 2088, Deltapine 12 and A, Delpress 3, Missdel 1 WR, and Miller 610. At six out of the nine test sites, no appreciable difference between the reactions of the resistant (including Cook 307, Cook Wiregrass, Dixie Triumph 12, Siker WR, and Clevewilt 6 and 7), and highly tolerant (Coker's 4 in 1, Dixie 14–5, Dixie Triumph 85, Toole, Cook 144–68, and Cook 1006) varieties could be discerned, but at the remaining three the former group was clearly superior to the latter. The increased severity of infection among the tolerant-resistant groups in two out of three localities may be attributed to potash deficiency (50 lb. or less replaceable potassium oxide per acre), while in the third root-knot nematodes were suspected of contributing to the virulence of the disease [*R.A.M.*, xix, p. 702].

The relatively constant ranking of cotton varieties with respect to wilt infection at the various experimental sites, regardless of the general severity of the disease, is

interpreted as evidence against the existence of physiologic [illegible] of the pathogen, matters of more practical concern to growers being the differential response of the varieties under observation to potash and the influence of seasonal and other environmental factors. In two localities where wilt was severe only on the susceptible (Lone Star Relief and Coker 100) and highly susceptible (Half and Half) varieties, correspondingly heavy applications of potash (8 per cent. or more) gave good results, whereas at another place, where the disease was exceptionally virulent, such treatments were beneficial only to the resistant group, which responded equally well, however, on another site to moderate amounts, larger quantities being harmful. The Sea Island variety, for the one year in which it was included in the tests, was immune from wilt in one place and showed only a trace of vascular discoloration near the end of the season in another.

Simpson (D. M.). **Factors affecting the longevity of Cottonseed.** — *J. agric. Res.*, lxiv, 7, pp. 407–419, 1 graph, 1942.

In connexion with laboratory and field studies on the factors concerned in the longevity of cotton seed, the percentage of seedling mortality at Knoxville, Tennessee, among plants raised from seed previously stored for 2½ years was higher in the lots kept at 33° F. than in those held at 90°, air temperature (unregulated), or 70°, the cooler conditions apparently favouring the survival of the anthracnose fungus [*Glomerella gossypii*]. Thus, in the Carolina Dell variety, the incidence of mortality ranged from 2·8 to 14·9 per cent. at 33°, 0·0 to 1·9 at 70°, 0·7 to 1·8 at air temperature, and was nil at 90°, the corresponding figures for Deltapine A being 3·7 to 25·4, 0·6 to 0·7, 0·0 to 2·9, and 0·7 per cent. These data corroborate those (unpublished) secured by Arndt and Boozer at the South Carolina Agricultural Experiment Station. In the course of further field trials viable spores of *G. gossypii* and *Fusarium moniliforme* [*Gibberella fujikuroi*: *R.A.M.*, xxi, p. 331] were detected on seedlings from seed stored for 3½ years at 33°, but not on those from seed held at the higher series of temperatures.

Fullerton (R. P.). **Methods of rot-proofing Cotton duck and canvas.** — *Irish Text. J.*, N.S., vii, 3, pp. 16–17, 1 diag., 1941.

Details are given of some processes which may be used as alternatives to the very complicated cuprammonium method of rot-proofing cotton duck and canvas [*R.A.M.*, xxi, p. 214]. A copper formate solution is prepared by the dissolution of 60 lb. copper sulphate in water, the resultant solution being mixed with one containing 40 lb. soda ash; a precipitate forms and is in turn dissolved in 2½ gals. 85 per cent. formic acid. A solution of aluminium formate is also prepared, consisting of 60 lb. aluminium sulphate, 50 lb. soda ash, and 4 gals. formic acid, and the cloth is impregnated with a mixture of the two solutions, dried, impregnated with dilute ammonia, and again dried.

C. Baswitz's patent (E.P. 16708–1889) is based on the fact that a solution of hydrate of copper oxide in spirits of sal ammoniac acts similarly to a solution obtained by the direct dissolution of copper in ammonia.

A simple treatment stated to be effective against mildew is carried out with the following ingredients: (1) 50 parts each of paraffin wax and wax copper oleate (50 per cent. of each) and 10 parts each of oleine and rosin in (2) 140 parts of water, to which are added, after blending, (3) 20 parts of water, 10 each of ammonia and amoa O.M., and (4) 30 parts each of lime green and water and 10 of amoa O.M. A suitable fixing bath for the material thus treated consists of a mixture of 25 lb. copper sulphate in 200 water and 25 lb. lead oleate in 200 water acidified with acetic acid.

Petch (T.). **Notes on entomogenous fungi.** — *Trans. Brit. mycol. Soc.*, xxv, 3, pp. 250–265, 1942.

This further contribution [*R.A.M.*, xviii, p. 736; xx, p. 301; xxi, p. 14] gives observations on 25 entomogenous fungi, including *Sorosporella uvella* (Krass.) Giard and its conidial stage *Synglocladium cleoni* (Wize) Petch, n.comb. (syn. *Acremonium cleoni*

Wize), attacking wireworms (*Agriotes* sp.) at Rothamsted, and *Spicaria prasina* [ibid., **xv**, p. 719] found in Norfolk on a caterpillar attached to a grass leaf, the first European record of this fungus.

Lima (A. O.). **Os fungos do ar em alergia respiratória. I. Revisão da principal literatura sôbre o assunto. II. O papel dos Basidiomycetos. III. Métodos para seu estudo. IV. Os esporos de Alternaria e helminthosporos na atmosfera da cidade de Belo Horizonte.** [Atmospheric fungi in connexion with respiratory allergy. I. Review of the principal literature on the subject. II. The role of the Basidiomycetes. III. Methods for their investigation. IV. The spores of *Alternaria* and helminthosporiosis in the atmosphere of the city of Bello Horizonte.]—*Brasil-med.*, lv, 31, pp. 529-533; 32, pp. 549–552; 41, pp. 693–697; 46, pp. 759–760, 13 figs., 1 graph, 1941.

Many of the papers included in this useful review of the relationship of certain groups of fungi to respiratory allergy have already been noticed here from the original sources, but it may be of interest to mention two cases of asthma attributed to tomato leaf mould (*Cladosporium fulvum*), both in the United States (*J. Allergy*, iii, p. 389, 1932; *Ann. intern. Med.*, vi, p. 655, 1932) [besides those already reported: *R.A.M.*, xvii, p. 821]. Attention may further be drawn to the part played by species of *Hormodendrum*, *Mucor*, *Penicillium*, and *Alternaria* in the inducement of certain allergic conditions in Cuba, and to the seasonal fluctuations of these moulds (*Arch. intern. Med.*, p. 121, 1935; *Rev. med. Cirug. Habana*, xliv, p. 411, 1939) [cf. *R.A.M.*, xxi, p. 370 *et passim*].

Entirely negative results were given by tests in 1940–1 with various cereal rusts and smuts, reported from other countries as agents of bronchial troubles [ibid., xx, p. 406].

Directions are given for the collection and isolation in pure culture of some well-known atmospheric contaminants, with notes on their morphological characters.

Seasonal and meteorological conditions were found, in a study of mould incidence in the atmosphere of Bello Horizonte, Minas Geraes, to exert no influence on the development of *Helminthosporium* and *Alternaria* spp., to which few of the patients tested by intracutaneous injections proved to be sensitive.

Martin (D. S.). **Studies on the immunologic relationships among various species of the genus Candida (Monilia).**—*Amer. J. trop. Med.*, xxii, 3, pp. 295-303, 1942.

Further studies at the Duke University School of Medicine, Durham, North Carolina, on the antigenic features of various species of *Candida* by means of the agglutination, complement-fixation, precipitation, and precipitin absorption reactions with immune rabbit sera [*R.A.M.*, xix, p. 535] revealed antigenic differences between *C. albicans*, *C. tropicalis*, and *C. parakrusei* notwithstanding the marked cross reactions between the three species. *C. stellatoidea* and *C. albicans* are more nearly related, though material quantitative differences in the amounts of antigen present were observed. In the writer's opinion, this antigenic similarity does not justify the exclusion of *C. stellatoidea* from specific rank as a mere variant of *C. albicans*, among the reasons for its retention as a separate entity being the differences between the two species in respect of preference for certain sites, colony and microscopic morphology, sugar fermentation reactions, pathogenicity for rabbits, and response to dissociation with lithium chloride [ibid., xix, p. 595].

Neill (J. C.). **Ergot.**—*N.Z. J. Sci. Tech.*, A, xxiii, 3, pp. 131–137, 8 figs., 1941.

The ergots produced by *Claviceps purpurea* on six-rowed Cape barley, occasionally on wheat and oats, and on perennial rye grass (*Lolium perenne*) and other pasture grasses, including *Glyceria fluitans*, *Festuca arundinacea*, *Dactylis glomerata*, *Holcus lanatus*, *Ammophila arenaria*, *Poa pratensis*, *Agropyron scabrum*, *Bromus inermis*, and *L. multiflorum*, in New Zealand are elongated, horn-shaped, black outside, and milky-white in the interior, whereas those formed by *C. paspali* (on *Paspalum* only)

[*R.A.M.*, xxi, p. 337] are irregularly spherical and dusky or pinkish-white both in- and outside. In other respects the morphology of the two species is identical. Single plants of rye (which has not yet been found naturally infected in the country) were inoculated with conidial suspensions of 14 strains of *C. purpurea* from 12 hosts, of which only one, originating in a sample of commercial ergot from Hungary [ibid., xviii, p. 314], induced heavy and uniform infection, though mild symptoms were observed on plants treated with the wheat strain. In a field trial to determine the practicability of commercial ergot production by the artificial inoculation of rye, the total yields of air-dried material, computed on an acreage basis for 7 in. rows, sprayed once, twice, and thrice with suspensions of *C. purpurea* containing 550 conidia per ml., were 115, 140, and 176 lb. No alkaloid was present in the samples submitted to the Dominion Analyst.

CUNNINGHAM (I. J.). **The chemistry, pharmacology, and toxicology of ergot (Claviceps purpurea).**—*N. Z. J. Sci. Tech.*, A, xxiii, 3, pp. 138–145, 1941.

Two of the alkaloids known to occur in ergot (*Claviceps purpurea*) [see preceding abstract], viz., ergotoxin and ergotamine, are known to possess, in addition to their pharmacological and medicinal properties, toxicological principles which introduce an element of risk into their therapeutic use. Ergometrine [*R.A.M.*, xiv, p. 697], on the other hand, combines medicinal virtues with freedom from toxicity to human beings and livestock, and attempts should therefore be made to develop a race of the fungus in which the proportion of this alkaloid is greatly increased.

RUSCHMANN (G.) & BARTRAM (H.). **Untersuchungen über den Verderb von Flachsfasern und Leinengarnen durch bakterielle und pilzliche Schädlinge.** [Studies on the spoilage of Flax fibres and linen yarns by bacterial and fungal pests.] —*Zbl. Bakt.*, Abt. 2, cii, 12–14, pp. 300–323; 15–17, pp. 365–387, 9 figs., 1940.

Heavy microbiological contamination of flax fibres, yarns, and wooden spools in a large spinning works afforded an occasion for intensive studies at the Institute of Soil Science and Plant Nutrition, Landsberg-an der Warthe (Germany) on the identity and prevalence of the organisms concerned. Among the numerous fungi detected on the yarns *Alternaria tenuis* played the most prominent part, rapidly and severely attacking both pectin and cellulose, with resultant decomposition of the fibres. The only other fungus possessed of similar destructive properties was *Monilia sitophila*, which was, however, seldom present on the materials examined and need not be further considered as a pathogen. *A. tenuis* was already excessively widely distributed on the straw flax, so that its extensive occurrence on the dew-retted flax [*R.A.M.*, xxi, p. 370], and even on the processed yarns from this source was to be expected. On the other hand, the fungus was not abundant on the samples retted by the warm-water method or on the finished products from them. Green flax and the corresponding yarn appeared to be free from *A. tenuis* and in general to harbour few micro-organisms. Other fungi detected in varying numbers on untreated yarns included *M. candida* [*Candida vulgaris*], *Cladosporium herbarum*, *Penicillium luteum*, *Mucor plumbeus*, and *M. mucedo*.

Wooden spools with crumbling and sticky surfaces bore a complex and numerous microflora, largely consisting of yeasts and wood-destroying fungi, but also including *Fumago vagans*, *Cephalothecium* [*Trichothecium*] *roseum*, *Trichoderma lignorum* [*T. viride*], and *A. tenuis* (the spores of which were abundant). Within one to two weeks, under appropriate moisture conditions, sterilized or unsterilized yarn spun on contaminated spools was largely disintegrated, chiefly by *A. tenuis*.

Cooking, especially with dilute sodium lye, and bleaching with chlorine reduced the incidence of fungal infection on yarn to insignificant proportions. In a moist chamber the moulds and yeasts succumbed to five minutes' exposure to a temperature of 80° C.

or one minute at 100°, in contrast to the bacteria concerned in the decomposition of the fibres, for the destruction of which a period of ten minutes at 100° was requisite.

Cass-Smith (W. P.). **Flax rust.**—*J. Dep. Agric. W. Aust.*, Ser. 2, 1, pp. 56–63, 4 figs., 1942.

Small areas of flax and linseed have been grown in many parts of Western Australia during the last thirty years, but cultivation on a large scale was not attempted until the outbreak of the present war. During the last two seasons, all seed for flax- or linseed-growing imported into Western Australia by either the State or the Commonwealth Government was carefully cleaned and treated with an organic mercury dust under departmental supervision before dispatch to farmers.

In August, 1941, Blue Riga linseed in the Northam area was attacked by an epidemic of rust (*Melampsora lini*) [*R.A.M.*, xxi, p. 256]. The affected plants were the second crop from a line of commercial seed bought locally in 1940. The seed had not been cleaned or dusted in either year, and both crops had been grown on the same land. Later virtually all the linseed crops in the Northam and adjacent areas developed the disease, but on the whole the damage was only slight. Afterwards a trace of rust was found in crops of fibre flax in certain south-western districts, including the Wokalup, Preston Valley, Bonnybrook, Harvey, and Yarloop areas. Flax rust has been recorded from all States of the Commonwealth, with the possible exception of Queensland. It was first reported in Western Australia in 1931, when a small plot of flax in the East Pingelly district was badly affected. It was not again observed until 1941.

The fungus attacks only cultivated and wild flax. Two species of the latter are found in the State, *Linum marginale* and *L. gallicum*. The former is indigenous and widely distributed throughout the south-west, while the latter is an introduced species and chiefly confined to the Vasse district. The disease has been reported on *L. marginale* in most of the eastern States of Australia, but it was not until the author recently examined some 'wild flax' specimens from the State Herbarium that typical symptoms of flax rust were discovered on a local plant of this species. This specimen was collected in the Wagin area in 1920, and as far as can be ascertained this is the first record of the disease on 'wild flax' in Western Australia.

Observations last season showed the most susceptible variety to be Blue Riga, followed in descending order of susceptibility by (2) Punjab, (3) Concurrent and Liral Crown, (4) Bison, and (5) Ottawa. The varieties locally grown appeared to be only slightly affected, not because they are resistant, but because early planting enables them to escape more serious damage. Until varieties of proved resistance can be introduced, all seed should be graded and cleaned, and the screenings burned. It should also be treated with ceresan or agrosan at the rate of 3 or 4 oz. per bush. of seed. Arrangements have been made for all seed issued to contract growers for this year's cropping to be cleaned and dusted before dispatch. Seeding should occur as early as possible within the correct period for each district, so that the crops may be well advanced in growth when liability to attack begins in the spring.

Mains (E. B.). **Phlox resistant to powdery mildew.**—*Phytopathology*, xxxii, 5, pp. 414–418, 2 figs., 1942.

At intervals since 1933 the writer has been engaged on a study of varietal reactions to powdery mildew (*Erysiphe cichoracearum*) of perennial phlox (*Phlox paniculata* and *P. maculata*) at Ann Arbor, Michigan, the investigation having been extended in 1935 to the annual *P. drummondii* [*R.A.M.*, xvi, p. 255]. A high degree of resistance was shown by the perennial selections of various colour types H1, DP4, DP19, DP20, and DP24 in 1934, 1935, and 1937, which broke down, however, in the severe epidemics of 1938 and 1941 (except in the case of DP4 in the latter year); the commercial varieties Miss Lingard and Columbia were moderately to very susceptible throughout the period of the tests. Of the *P. drummondii* selections, the large-flowered, pomegranate-

purple to rose-red (Ridgway), white-eyed strain No. 67-25 was the most promising, all the 91 plants inoculated in the greenhouse in 1941 being highly resistant, whereas 168 of a commercial line were susceptible. The occurrence of several physiologic races of phlox mildew was indicated by the field evidence of 1938 and 1941.

JENKINS (ANNA E.). **A new species of Sphaceloma on Poinsettia.** *Proc. biol. Soc. Wash.*, lv, pp. 83–84, 1942.

Sphaceloma poinsettiae n.sp. is the name applied to the causal organism of scab on poinsettia (*Euphorbia pulcherrima* var. *plenissima*) in Florida and Hawaii [*R.A.M.*, xxi, p. 371], *E. poinsettia* also having shown mild infection in the former locality. The spots on the leaf veins are raised, pale buff with a purple to nearly black margin, up to 4 by 2 mm.; those on the laminae are circular, raised below and concave above, pale buff to liver-brown (Ridgway), up to 3 mm. in diameter; and those on the margins roughly hemispherical, causing an inward rolling of the leaf. Stem cankers are numerous, circular to elliptical or elongated, raised, tending to sink in the centre, pinkish-buff, sometimes purple-edged with a red or purple surrounding zone, 1 mm. to 1 cm. by 1 to 8 mm., becoming confluent and girdling the stem, causing death of the upper portion.

The conidiophores, arising from a stroma composed of hyaline to pale yellow hyphae, are continuous to uniseptate, pale to brown, 15 to 30 by 3 to 5 μ, and produce elliptical to oblong, occasionally cylindrical or spherical, simple or uni-, rarely biseptate, conidia of a similar colour to the conidiophores, 7 to 20 by 2·5 to 5·3 μ, forming over the lesions an inconspicuous grey to olive-brown coating.

JENKINS (ANNA E.) & BITANCOURT (A. A.). **An Elsinoe causing an anthracnose of Virginia Creeper.** *Phytopathology*, xxxii, 5, pp. 424–427, 1 fig., 1942.

Elsinoe parthenocissi n.sp. is the name applied to a fungus causing a destructive anthracnose of the leaves, stems, and fruits of Virginia creeper (*Parthenocissus quinquefolia*) near Marlboro, New Hampshire, and found to be identical with herbarium material of the same disease collected by A. W. Chapman in Florida in 1891. The organism is characterized by a hyaline to faintly yellowish pseudoparenchyma of isodiametric, fairly thick-walled cells; ascomata 70 to 160 μ in diameter and 35 to 80 μ in thickness; and mostly globose asci with a thin outer and thick inner wall, 17 to 25 μ in diameter, each containing eight triseptate, straight or somewhat curved spores, 12 to 17 by 6 to 8 μ, these dimensions exceeding those of *E. ampelina* [*R.A.M.*, ix, p. 66], the only other species of *Elsinoe*, besides *E. viticola*, known on Vitaceae.

The pathogen produces on the leaves varying numbers of well-defined, subcircular to circular, occasionally irregular, vinaceous brown, clove brown (Ridgway)-bordered lesions, 0·2 to 4 mm. in diameter, tending to fall out with a shot-hole effect; on the stems and petioles raised, pale, dark-edged cankers; and on the fruits greyish-white spots (as defined by Alma E. Waterman) [ibid., xxi, p. 53].

RAMSBOTTOM (J.). **Gloeosporium nicolai Aggéry and Gloeosporium polypodii Aggéry.** *Trans. Brit. mycol. Soc.*, xxv, 3, p. 334, 1942.

The author states that Mlle B. Aggéry's drawings and descriptions of *Gloeosporium nicolai* on *Scolopendrium officinale* and *G. polypodii* on *Polypodium vulgare* and on *P. vulgare* var. *serratum* [*R.A.M.*, xv, p. 809] show the former to be *Milesia* (*Milesina*) *scolopendrii* and the latter to be *Milesia polypodii* (*Milesina dieteliana*), while a form of *G. polypodii* on *Aspidium aculeatum* is probably *Milesia whitei* [cf. ibid., xvi, p. 63].

GRAY (ELIZABETH G.). **Phialea mucosa sp. nov., the blind-seed fungus.** *Trans. Brit. mycol. Soc.*, xxv, 3, pp. 329–333, 1942.

In the course of studies on low germination in rye-grass (*Lolium perenne* and *L.*

multiflorum) the author noted the resemblance between the 'blind seed' fungus [*R.A.M.*, xx, p. 122; xxi, p. 2] and *Endoconidium temulentum*. The perfect stage has been assigned in turn to *Phialea*, *Stromatinia*, and *Sclerotinia*. Measurements of apothecia, ascospores, and microconidia agree closely in the two fungi, and the microconidia in all are developed endogenously. Macroconidia have not been described for *Sclerotinia temulenta*. Flowering rye has been successfully inoculated with the 'blind seed' fungus, but apothecia have not yet been obtained from infected rye grains.

The 'blind seed' fungus is an inoperculate Discomycete which has features in common with *Sclerotinia*, *Ciboria*, *Helotium*, *Phialea*, and *Stromatinia*. Anatomical examination was made of fresh or dried material of representative species of all these, and showed that the anatomy of the apothecium provides a very reliable taxonomic character. The structure of the apothecium of the 'blind seed' fungus is very uniform, and consists throughout of parallel hyphae, forming a typical 'textura porrecta', with a very slight tendency to irregularity in the centre of the excipulum immediately under the hypothecium. In *Sclerotinia*, *Stromatinia*, and *Ciboria* the excipulum consists of two layers, the inner of a loose 'textura intricata' of slender hyphae, and the outer of wide hyphae which form a 'textura oblita'. In *Phialea* the excipulum consists of slender parallel hyphae which form a 'textura porrecta' in the stalk and merge into a 'textura oblita' under the hypothecium.

The 'blind seed' fungus agrees fairly closely in structure with species of *Phialea* and differs strikingly from the other genera. The fungus is therefore assigned to this genus, and is named *P. mucosa* n.sp.; this conclusion is, however, tentative until the relation of the fungus with *S. temulenta* has been established or disproved.

P. mucosa n.sp. is described as having small, fleshy apothecia arising singly or 1 to 7, usually 1 or 2, from colourless, septate intertwining hyphae, 3 to 4 μ in diameter, ramifying through the pericarp, testa, and endosperm; pale pinkish-cinnamon disks darkening to cinnamon when old, 1 to 3·5 (most frequently 2·5) mm. in diameter, at first almost closed, opening into a cup shape and finally becoming flat or slightly recurved, with a smooth margin; smooth, cylindrical stalks, 1 to 8 mm. long, 0·4 mm. in diameter, with a structure fairly uniform, consisting of parallel hyphae occasionally intertwining and seldom branched, forming a 'textura porrecta', with cells in the stalk 20 to 30 by 3 to 4 μ, grading into the more interlaced hyphae of the excipulum, with cells 18 to 24 by 4 to 6 μ, passing gradually into the hypothecium, which is 22 to 27 μ deep and composed of fine, interlacing hyphae 2 μ in diameter. The 8-spored, cylindrical-clavate asci, 66 to 116 by 3·3 to 7 μ, most frequently 73 by 6 μ, are very little thickened at the apex, and the pore does not stain blue with iodine; the smooth, unicellular, ellipsoidal ascospores have pointed ends and measure 7·6 to 12 by 3 to 6 μ, most frequently 9·5 by 4·5 μ; they lie obliquely uniseriate in the upper half to three-quarters of the ascus; on germination each ascospore produces first a terminal germ-tube and then a second, frequently lateral and usually constricted at the point of origin; the paraphyses are simple, filiform, hyaline, 2 to 4 μ broad, not swollen at the apex.

The cylindrical to slightly crescentic macroconidia have rounded ends and measure 11 to 21 by 3·3 to 6 μ, most frequently 16 by 4 μ. They are formed in large numbers from the apices of short outgrowths from hyphae on the pericarp, producing a pink slime on the surface of the ovary. The microconidia occur in pink, pulvinate sporodochia, 1 to 1·5 by 0·5 mm., on the surface of caryopses; the conidiophores are septate, hyaline, and two or three times branched; the microconidia are unicellular, uninucleate, ovoid, hyaline, and measure 3·4 to 4·8 by 2·7 to 3·2 μ, most frequently 4 by 3 μ, the first formed by a constriction below the apex of the conidiophore, the remainder developed successively in a tube measuring 5 by 3 μ formed by the terminal portion of the conidiophore. Germination was not observed. The apothecia were found on dead or occasionally germinated caryopses of *Lolium perenne* and *L. multiflorum* in June, the macroconidia on the ovary throughout the summer, and the microconidia on caryopses on the soil usually in February and March, occasionally until June.

KEARNS (H. G. H.) & MARSH (R.W.). **A summary of fruit spraying programmes : 1942 revision.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 59–69, [1942].

In this paper the standard spray programmes recommended to fruit growers in the Bristol Province in 1936 [*R.A.M.*, xvi, p. 817] are revised and brought up to date.

PLAGGE (H. E.). **Controlled atmosphere storage for Jonathan Apples as effected by restricted ventilation.** *Refrig. Engng.* xliii, 4, pp. 215–220, 2 figs., 2 graphs, 1942.

At the Iowa Agricultural Experiment Station the storage of comparable samples of Jonathan apples at 31° to 32° and 35° to 36° F. at carbon dioxide levels of 7, 9, and 11 per cent. increased the marketable storage period of the fruit over that of air-stored samples by three to four months, the corresponding period for a 3 to 4 per cent. carbon dioxide concentration being two to three months [*R.A.M.*, xxi, p. 82]. The carbon dioxide-treated fruit was of a firmer texture, more attractive colour, and better eating quality than the controls, and Jonathan spot was absent. Storage under conditions of restricted ventilation did not enhance the tendency to scald, but at 32° and the two upper carbon dioxide levels, brown heart and soggy breakdown developed.

SMOCK (R. M.) & SOUTHWICK (F. W.). **Some factors affecting Apple scald disease.** *Science*, N.S., xcv, 2475, pp. 576–577, 1942.

In two years' experiments with Rhode Island Greening apples promising results in the control of scald [*R.A.M.*, xxi, p. 82] were obtained by coating the fruit with a wax emulsion (brytene 489 AM). With prematurely picked apples control was less good than that given by oiled paper, but with pickings made at the normal time it was equally good. Waxing keeps the fruit in greener crisper condition than oiled paper, and it is suggested that small commercial trials of this treatment should be made, using 6 to 8 per cent. solids in the emulsion.

Volatile products from one lot of apples may induce scald on a second lot [ibid., xviii, p. 117]. Susceptible varieties scald much sooner and more severely in the presence of volatiles from McIntosh apples than when stored alone, both in ordinary cold storage and in atmospheres in which the carbon dioxide and oxygen levels as well as temperature and humidity were controlled.

Progress has been effected in conditioning storage atmospheres to rid them of the harmful volatiles, using various oils and activated charcoal. Failure to obtain complete control is attributable partly to lack of knowledge as to when the absorbents become saturated.

FAES (H.), STAEHELIN (M.), & AUBERT (P.). **Recherches sur la conservation des Pommes et des Poires.** [Studies on Apple and Pear preservation.]—*Annu. agric. Suisse*, lvi, 3, pp. 207–277, 7 figs., 8 graphs, 1942. [German summary.]

Included in this comprehensive, fully tabulated account of studies which have been in progress since 1933 at the Federal Viticultural and Arboricultural Experiment Station, Lausanne, on the keeping qualities of apples and pears under various conditions of storage (refrigerator, cellar, and open air) are numerous references to the disorders incidental to the different varieties used in the tests. The development of fungal rots, e.g., *Penicillium*, *Mucor*, *Botrytis*, and *Rhizopus* spp. [*R.A.M.*, x, p. 801], may be prevented by regular fungicidal treatments throughout the growing season, careful selection of exclusively sound fruits for the storage room, and the annual fumigation of the latter with sulphur (10 to 20 gm. per cu. m.) or formalin at the rate of 20 c.c. plus 20 c.c. water and 8 gm. potassium permanganate per cu. m. Internal breakdown chiefly affects the White Calville, Red Rome Beauty, Jonathan, and Mans Pippin apple varieties stored at a temperature round about 0° C., the damage at 3° to 4° being much less serious. Susceptibility to scald is most in evidence in the Canadian and Grey Pippins, Beurré Six, Louise Bonne, Doyenné d'hiver, and Clairgeau. Lenticel spotting, the form of scald so prevalent in England [ibid., xviii, p. 116], is relatively

infrequent on the apple varieties chiefly cultivated in Switzerland, but occurs on the Pineapple, Landsberg, and Mans Pippins. In general, a temperature between 2° and 4° and a humidity of 85 to 90 per cent. constituted the most favourable atmosphere for the cold storage of apples in these experiments. The application immediately prior to storage of a wax coating to such rough-skinned varieties as Beauty of Boskoop and Canadian Pippin is recommended as a precaution against wrinkling.

McKay (R.). **Apple scab and its control at Glasnevin in 1939, 1940 and 1941.**—*J. Dep. Agric. Éire,* xxxix, 1, pp. 46–79, 6 pl., 1 diag., 1942.

Further spraying tests carried out in Éire against apple scab (*Venturia inaequalis*) [*R.A.M.*, xviii, p. 531] from 1939 to 1941 are described. In the first two seasons the weather was unfavourable to infection, but a considerable amount of scab developed on trees that had not been sprayed for some years. In 1941 infection was severe, although less rain fell during the growth season than had been the case in 1939 and 1940. The severity of the 1941 outbreak is attributed to the fact that March and April were wet, and during these months scab pustules on the bud scales reached a maximum state of development, to cold winds at flowering, which was nearly one month later than normal, foliage development being retarded at a very susceptible stage, and thirdly, to lack of sunshine in summer.

Ascospore infection is believed to have been eliminated during these tests. Scabbed one-year-old wood contributed to infection only in 1939. In each year, the chief source of initial infection was infected bud-scales. In the spring, the presence of this source of infection is indicated by characteristic outbreaks on rosette leaves and those surrounding the flower trusses.

Primary infections on the under sides of the foliage were conspicuous on an Allington Pippin tree in 1941, and resulted from contact between the developing leaves and diseased bud-scales, subsequent growth carrying the contaminated point beyond the source of infection. This type of primary undersurface infection has generally been attributed to wind-borne ascospores coming into contact with the dorsal leaf surface, which is first exposed from the bud. The cumulative effect of the disease on Bismarck takes the form of badly infected foliage, reduced current season's growth, premature defoliation, fewer fruit buds, and worthless fruit.

One pre-blossom application of lime-sulphur (1 in 30 or 1 in 40) and two post-blossom applications of the same (1 in 60 or 1 in 80) on Allington Pippin, Bramley's Seedling, King Edward VII, and Gascoyne's Scarlet apples resulted in over 95 per cent. clean fruit in 1939 and 1940, and over 90 per cent. in 1941. One pre-blossom application of Bordeaux mixture (2–6–40) and two post-blossom treatments (2–6–40 and 1–3–40) on Bramley's Seedling gave a higher percentage of clean apples each year than three corresponding applications of lime-sulphur, the differences being greatest in 1941. The evidence showed that where the disease has been kept well in check, a green-bud spray, whether of lime-sulphur or Bordeaux mixture, is superfluous. The second post-blossom spray is more important. Highly susceptible varieties, such as Bismarck and Annie Elizabeth, may require more than two post-blossom sprays. Lime-sulphur injury results in scorching, checking, and crippling of the young foliage, but these effects are less lasting than the damage due to Bordeaux mixture, which consists in fruit-russeting and leaf-hardening; in 1941, a secondary effect of Bordeaux spray on Bramley's Seedling trees was the production of premature leaf fall.

Singh (U. B.). **The soft-rot of Apple fruit in Kumaun.**—*Indian J. agric. Sci.*, xi, 6, pp. 902–905, 13 figs., 1941.

Penicillium expansum, the agent of a soft rot of stored apples, first recorded for India at Chaubattia (United Provinces) in 1934, then in Baluchistan [*R.A.M.*, xv, p. 587], and now in Kumaun, produces on the fruits of Delicious and other varieties

watery, light or yellowish-brown areas, on which, under conditions of extreme humidity, a bluish-green sporulating growth develops. Infection may also originate at the stem and calyx ends. A characteristic musty odour is given off from diseased fruit. The rot may cause substantial losses of up to 75 per cent. Particulars are given of the symptoms of the disease and the morphology of the fungus. The results of inoculation experiments on Bramley's Seedlings indicated that the pathogen can enter only through skin injuries, which should be avoided by the observance of stringent precautions in picking (including the use of gloves if necessary), grading, and packing: the fruit should be wrapped with wrappers treated with double-boiled linseed oil, and in packing the pad of wrapping paper should be placed so as to minimize the risk of contact between the stem of one fruit and the epidermis of another. Fruit showing the least sign of skin injury or rotting should be removed.

WILKINSON (E. H.). **A note on the so-called dry eye rot of Apples associated with Botrytis cinerea Pers.**—*Rep. agric. hort. Res. Sta. Bristol, 1941*, pp. 72–75, 1 pl., [1942].

Observations on a large number of apples affected with the 'dry eye rot' disease associated with *Botrytis cinerea* [*R.A.M.*, xx, p. 169; xxi, p. 259] showed that the development of infection falls into three stages. In the first, a slight redness appears at the base of one or more calyx segments towards the end of July. The reddened area expands slowly in a radial manner away from the calyx, leaving light brown skin behind. Expansion is slow, and was observed in some cases to continue until the first week of September. By this time, the lesions range from $\frac{1}{2}$ to 1 in. in diameter. Internally, the tissues to a depth of $\frac{1}{10}$ in. beneath the discoloured skin are soft, water-soaked, and light brown.

In the second stage, the lesions cease growing and dry out. The overlying skin subsides and turns dark brown or black. It assumes a stretched, parchment-like appearance, often becoming detached from the surrounding healthy skin at the periphery. Internally, the water-soaked tissues dry out and become tough. At this stage, the lesions are approximately circular and either surround the calyx or, more often, are situated on one side of it. Their periphery is clearly defined, and is surrounded by a thin band of red skin.

The lesions remain in the quiescent condition reached at the end of the second stage for a few weeks. Then, in October and November the third stage sets in, the healthy skin immediately surrounding the lesions becomes light brown and spreads, until after about 14 days the whole apple is involved in a soft rot of the *B. cinerea* type. Isolations made from apples showing rot in stages one and two gave pure cultures of *B. cinerea*. Inoculations of apples through pricks in the laboratory, produced typical *Botrytis* rots, but when the process was repeated at the base of calyx segments of Laxton's Superb apples (which appear to be the most susceptible) while on the tree, either total rots or complete failure to take resulted.

Affected apples may carry the fungus into storage. A count of a sample of Laxton's Superb apples in September, 1941, showed 178 fruits to be infected with dry eye rot. On 30th October, 123 or 69·1 per cent. were completely rotted, and in a few instances the infection had spread to adjacent healthy apples. The disease is most prevalent after a wet July or August. If attack by *B. cinerea* is to be kept at a minimum, it is essential that all fruits with dry eye rot should be immediately discarded.

ROACH (W. A.). **The use of plant injection in plant pathology.**—*Trans. Brit. mycol. Soc.*, xxv, 3, p. 338, 1942.

The author states that in the course of his plant injection studies [*R.A.M.*, xviii, p. 539; xix, p. 283] apple shoot treatment with sodium thiosulphate has controlled *Podosphaera leucotricha*, and injection of plum trees with a disinfectant or a nutrient has cured silver leaf (*Stereum purpureum*), at least temporarily.

LANGFORD (M. H.) & KEITT (G. W.). **Heterothallism and variability in Venturia pirina.** —*Phytopathology*, xxxii, 5, pp. 357–369, 3 figs., 1942.

It is concluded from the results of a genetic study on the pear scab fungus, *Venturia pirina*, at the Wisconsin Agricultural Experiment Station, a preliminary account of which has already been noticed [*R.A.M.*, xix, p. 548], that the species is composed of numerous biotypes differing in morphology and pathogenicity. The inheritable variations in these characters arise from fertile unions between members of the two groups of hermaphroditic but self-incompatible thalli.

MITTMANN-MAIER (G[ERTRUD]). **Untersuchungen über die Anfälligkeit von Apfel- und Birnensorten gegenüber der Moniliafruchtfäule.** [Studies on the susceptibility of Apple and Pear varieties to *Monilia* fruit rot.]—*Gartenbauwiss.*, xv, pp. 334–361, 1940. [Abs. in *Hort. Abstr.*, xii, 2, p. 89, 1942.]

From 1937 to 1939, observations were made at the Geisenheim (Rhine) Horticultural Research Station in September and October on the ripe fruits of 158 apple and 111 pear varieties inoculated with *Monilia* [*Sclerotinia*] *fructigena* and *M. cinerea* [*S. laxa*: see next abstract]. The most resistant apple varieties were Rheinischer Bohn, Pomeranzen, Zwiebelborsdorfer, Roter Winterstettiner, Gelber Winterstettiner, Medina, and Ribston Pippin, while the most resistant pear was the Station-bred Sämling Muth, followed by Gestreifte St. Germain, Olivier de Serres, Edelcrassane, Souvenir de Constantin Bernard, Charles Cognée, and Schöne [Belle] Angevine.

MAIER (W.). **Ueber ein Zweigsterben der Aprikosen als Folge von Monilia-Fruchtfäule.** [On an Apricot branch die-back as a sequel to *Monilia* fruit rot.]—*Z. PflKrankh.*, lii, 2–4, pp. 91–107, 12 figs., 1942.

During the summer of 1941, apricot trees at and near the Geisenheim (Rhine) Horticultural Research Station were observed to be suffering from a destructive die-back of the branches caused by *Monilia cinerea* [*Sclerotinia laxa*] and *M.* [*S.*] *fructigena*, and closely resembling a cherry disease already described from the same locality [*R.A.M.*, xx, p. 24]. In many cases the entire crown of the tree was involved and had to be removed. Infection was found to originate in the fruits, whence the mycelia of the pathogens proceeded through the pedicels into the branches, where it spread through the phloem and xylem, obstructing the supply of water to the leaves by the accumulation of hyphae, formation of tyloses, and the deposition of gum, and causing the cessation of cambial activity or even the dissolution of the cambium.

The cherry disease previously reported (which also affects apricots) is almost exclusively associated with *S. laxa*, and a cultural study was therefore made to confirm the presence of *S. fructigena* in the infected material. The morphology of the mycelium and conidia left no doubt as to the identity of the pathogen, the conidial dimensions of the strain from apricot measuring 21·2±0·16 by 13·2±0·10 μ, compared with 19·2±0·18 by 12·7±0·29 and 20·4±0·17 by 13·8±0·13 μ for isolates of *S. fructigena* from cherry and apple, respectively, and 15·9±0·15 by 11·0±0·12 and 15·3±0·15 by 10·7±0·11 μ for strains of *S. laxa* from peach and apricot mummies, respectively. It is evident from these observations that the scope of *S. fructigena* is not limited to the fruit in Germany, as heretofore assumed.

Among the varieties most susceptible to the *Sclerotinia* die-back are the Pineapple, Jony, Nancy, Syrian, Moorpark, and Royal, while a high degree of resistance was shown by 15, including Goutte d'Or and Ambrosia, and nine were of intermediate reaction, among them Red Muscadine and Triumph of Treves. The development of varieties resistant to the pathogens will, in all probability, be the final solution of the control problem, and evidence is presented by the writer (in a forthcoming paper in *Angew. Bot.*, 1942) of hopeful possibilities in this direction. The timely removal of all infective material from the trees is beset with great practical difficulties, but in addi-

tion to the excision of all dead twigs (in which the fungi overwinter), the feasibility of early harvesting, before the fruits are extensively involved, should be considered.

DENHAM (H.) & WORMALD (H.). **The brown rot diseases of the Apricot.**—*J. R. hort. Soc.*, lxvii, 8, pp. 261–263, 1942.

One cause of apricot die-back in England is infection by *Monilia cinerea* [*Sclerotinia laxa*] [*R.A.M.*, xix, p. 602], which is found on flowers and young leaves, in the tissues of the affected twigs, and on the fruit. Infection arises from spores shed from fructifications on dead twigs and spurs and mummified fruits left on the tree from the previous year. The fungus infects the blossom producing wilt, spreads to the twigs giving rise to twig blight, and later attacks the fruit, causing brown rot. Infection generally begins at wounds made by insects or birds, but may arise through an affected fruit touching a healthy one. *S. fructigena* also attacks stone fruits, including apricots [see preceding abstract], but is not known to infect the flowers.

For control purposes, growers are advised to try a tar-oil spray as late as possible in winter, but before the buds begin to swell. Spraying should be carried out just before the flowers open with Bordeaux mixture, using 10 oz. copper sulphate and 15 oz. hydrated lime per 10 gals. water. Infected twigs and spurs should be cut out, preferably two or three weeks after blossoming.

WORMALD (H.). **Bacterial diseases of stone-fruit trees in Britain. VIII. Bacterial canker of Peach.**—*Trans. Brit. mycol. Soc.*, xxv, 3, pp. 246–249, 3 figs., 1942.

Continuing his studies on bacterial diseases of fruit trees in Britain [*R.A.M.*, xviii, p. 122], the author states that peach bacterial canker was observed in May, 1927, but has never been found since. Only one tree was affected, a Hale's Early, grafted on Black Damas C. Die-back was present, one side being nearly dead, and the cortex brown along the entire length of the main branch. The affected cortex was found to contain an organism which in its main characters agreed with *Pseudomonas mors-prunorum* [ibid., xxi, p. 25], to which it is referred; inoculations with it into peach, plum, and cherry branches resulted in typical bacterial cankers.

The chief characters common to the peach organism and other strains of *P. mors-prunorum*, and distinguishing them from *P. prunicola* were as follows: in nutrient broth + 5 per cent. saccharose and in Uschinsky's solution a white cloudy growth without any yellowish tint; on nutrient agar+5 per cent. saccharose a rapid production of acid, usually with death in four to six days; and on nutrient agar+2 per cent. lactose, with bromo-cresol purple as indicator, an alkaline, later acid reaction, the medium turning yellow.

The strains of *P. mors-prunorum* that have come under study vary among themselves in their reaction when grown in milk cultures. Typically, they produce a solid curd with an acid reaction (yellow in milk containing bromo-cresol purple), but with a little whey above the curd. After six months the peach strain gave the following reactions: in plain milk, indistinguishable from control tubes in colour and consistency, except for a trace of precipitate; in litmus milk, a trace of precipitate, and colour somewhat deeper than controls; in milk with bromo-cresol purple, a very slight change towards acidity, but no curdling; and in methylene blue milk, eventually greenish (dark bluish glaucous of Ridgway). The characters in which the peach strain deviates from the type in milk cultures are not regarded as having any specific significance.

MCCOLLAM (M. E.). **Prune trees need plenty of potash.**—*Bett. Crops*, xxvi, 2, pp. 15–18, 38–40, 10 figs., 1942.

Prune trees in California tend to suffer from potash deficiency, expressed by stunted, severely scorched, chlorotic foliage and small, 'sunburnt' fruit, among the soils giving rise to this trouble being Pinole loam, Rincon clay loam, and Conejo clay adobe. The four-year average yield in orchard plots of dried fruit of French prune trees treated with sulphate of ammonia and sulphate of potash (2½ lb. actual potassium oxide per

tree) was 4,210·5 lb. per acre compared with 2,282·7 for the control, the corresponding figures for 1941 being 5,706 and 2,844 lb., respectively. Sugar prunes over a four-year period gave an average yield of 2,140·3 lb. per acre in response to borax compared with 1,473·7 for the control, the corresponding figures for 1941 being 2,025 and 1,422 lb., respectively. The yields of green fruit from borax-treated French prune trees in 1939 and 1940 were 5,831·2 and 7,827·1 lb. per acre, respectively, while the controls yielded 881·2 in 1939 and a worthless crop in 1940. Leaf analyses in 1940 revealed a potassium content of 0·99 and 0·34 per cent. in the treated and untreated trees, respectively, with residues in 1941 of 0·77 and 0·2 per cent., respectively. In 1940 the leaf contents in potassium of two rows of newly planted French prunes receiving nitrogen and phosphorus, potash alone, and nitrogen-phosphorus-potash were 1·04, 1·84, and 2·19 per cent., respectively, as against 1·58 for the untreated controls, the corresponding figures for 1941 being 1·02, 1·50, 2·08, and 1·38 per cent., respectively, indicating that potash enters the tree more readily in the company of nitrogen and phosphorus than alone, whereas these two elements without potash reduce the potash content below that of the untreated trees. Generally speaking, a potassium content in the foliage of under 1 per cent. is expressed by deficiency symptoms, which are apt to become acute with a further drop below 0·5 per cent. It may well be desirable, from the standpoint both of quantity and quality, to build up the potassium levels in prune foliage to 2½ per cent.

THOMAS (H. E[illegible]L). **Transmissible rough-bark diseases of fruit-trees.**—*Phytopathology*, xxxii, 5, pp. 435–436, 1 fig., 1942.

Among the comparatively unfamiliar rough-bark group of virus diseases affecting fruit trees in central and northern California may be mentioned those of the diamond canker type [*R.A.M.*, xxi, p. 83] on apricot, cherry, plum, prune, and the Pink Radiance rose variety, all of which persist in scions: cankers very similar to those on prune have also been collected by H. N. Hansen on alder (*Alnus? rhombifolia*). Citrus psorosis [see above, p. 449] is another member of this group. A disorder of Gravenstein apple, known locally as 'flat limb' or 'crinkle wood', is characterized by irregularities in wood development but may be included in this group also because of the rough-bark symptoms produced when graft inoculations are made on *Pyracantha gibbsii yunnanensis*. Bosc pears may show symptoms not greatly unlike those of the Gravenstein disease; they also suffer from measles, oak bark (involving excessive sloughing), stony pit [ibid., xviii, p. 463], and a disease similar to or identical with the last-named, inducing no fruit symptoms when top-worked on the Bartlett, Comice, and Hardy varieties, but causing a foliar mosaic in Hardy.

MILBRATH (J. A.) & ZELLER (S. M.). **Rough-bark, a virus disease of flowering Cherry.**—*Phytopathology*, xxxii, 5, pp. 428–430, 1 fig., 1942.

Out of 3,887 Kwanzan flowering cherries (*Prunus serrulata*) in a nursery planting in Oregon, 592 were observed in 1939 to be stunted, producing few lateral branches, the bark being of a deep brown colour and roughened by longitudinal splitting, while the leaves were clustered together owing to internodal shortening and mostly arched downwards through faulty development of the midribs. Two larger trees were similarly affected, the splitting and rugosity of the bark, however, being more pronounced than in the young ones. In experiments to determine the transmissibility of the disease, one lot of 25 mazzard [*P. cerasus*] seedlings was budded with buds from a normal Kwanzan tree, another with those from a rough-bark tree, and a third with buds from both the healthy and affected trees. At the age of two years, the stocks on which normal buds were grafted produced 22 well-developed trees, those budded from the diseased Kwanzan yielded only six, all dwarfed and showing typical rough-bark symptoms, while of the trees grafted with healthy and diseased buds, both developed on seven, only the normal on nine, and only the diseased on three, all the growth

resulting from these unions being characteristically affected. The production of nine rough-bark trees by the normal bud, whilst the diseased bud did not develop, indicates that the virus was transmitted even without organic union being effected, and this was confirmed on subsequent tests. Apparently normal shoots have developed in many instances from the roots of diseased mazzard trees, suggesting that this host may become a symptomless carrier of the infective principle, presumably a virus, for which the name of *Prunus* virus 9 (or alternatively, *Rimocortius kwanzani*) is proposed.

THIRUMALACHAR (M. J.). **Phragmotelium mysorensis, a new rust on Indian Raspberry.** —*Proc. Indian Acad. Sci.*, Sect. B, xv, 4, pp. 186–193, 17 figs., 1942.

In addition to *Phragmotelium formosanum* (Hirats.) comb. nov., *P. okianum* (Hara) comb. nov., and *P. rubi-fraxinifolii* (Syd.) comb. nov. (transferred from *Phragmidium formosanum* [*R.A.M.*, xiv, p. 654], *P. okianum*, and *P. rubi-fraxinifolii* (*Ann. mycol., Berl.*, xix, pp. 161–175, 1921), respectively), another species of *Phragmotelium* has recently been detected on the leaves of *Rubus lasiocarpus* in the Nandi Hills, Mysore, and is here fully described as *P. mysorensis* Thirumalachar & Mundkur n.sp. The rust is confined to the foliage, on which it produces extensive blotches. Uredo- and teleutosori develop in August and September, and pycnidia and aecidia during October and November.

CANDIOLI (P.). **Contributo alla conoscenza della causa della mortalità del Ciliego.** [A contribution to the knowledge of the cause of Cherry mortality.]—*Ital. agric.*, lxxix, 4, pp. 207–214, 7 figs., 1942.

An important cause of the dying-off of sweet cherries in the Verona district of Italy was found to be the physiological disequilibrium resulting from the use of an incompatible stock, *Prunus mahaleb*, of which the *cupaniana* variety is the least well adapted for the purpose in view, *typica* being more suitable and *transilvanica* intermediate in this respect. The lack of harmony between stock and scion (Durona di Verona) is manifested by severe constriction below the site of grafting and hypertrophy above it.

DEMAREE (J. B.). **Diseases of Strawberries.**—*Fmrs' Bull. U.S. Dep. Agric.* 1891, 27 pp., 11 figs., 1942.

This bulletin, superseding No. 1458 in the same series, contains all the necessary information for the recognition and control of the following diseases affecting strawberries in the United States: leaf spot, scorch, and blight (*Mycosphaerella fragariae*, *Diplocarpon earliana*, and *Dendrophoma obscurans*, respectively); crinkle, xanthosis, and June yellows (non-infectious leaf variegation); red stele (*Phytophthora fragariae*), apparently limited to the northern strawberry regions by the high summer temperatures of the south; black seed (a minor manifestation of *M. fragariae*, chiefly affecting the Blakemore and Pathfinder varieties and characterized by black spots, $\frac{1}{4}$ in. in diameter, round the seeds and superficial discoloration of the underlying pulp); grey, tan, hard, and leather rots (*Botrytis* sp., *Pezizella lythri*, *Rhizoctonia* sp., and *Phytophthora cactorum*, respectively), all occurring both in the field and in transit; and leak (*Rhizopus nigricans*).

TRAUB (H. P.), ROBINSON (T. R.), & STEVENS (H. E.). **Papaya production in the United States.**—*Circ. U.S. Dep. Agric.* 633, 36 pp., 8 figs., 1942.

This circular contains brief notes (pp. 30–32), based on the investigations of H. E. Stevens, on the symptoms and control of papaw leaf blight (*Asperisporium caricae*), powdery mildew (*Oidium* [*caricae*]), fruit rot (*Colletotrichum* [*?gloeosporioides*]), and damping-off (*Rhizoctonia*) [*R.A.M.*, xx, p. 26].

GOLDSWORTHY (MARION C.), GREEN (E. L.), & HALLER (H. L.). **Fungicidal properties of 2, 4-diaminodiphenylamine and other substituted diphenylamines.**—*J. agric. Res.*, lxiv, 11, pp. 667–678, 1942.

The toxicity of a new fungicide, 2,4-diaminodiphenylamine [U.S. Patent No.

2,203,431] was tested on cultures of the peach brown rot organism *Sclerotinia fructicola* and the apple bitter rot organism *Glomerella cingulata*; and in limited field spraying tests during 1939 and 1940 on apples against *Venturia inaequalis* and russet; on cherries against *Coccomyces hiemalis*; and on peaches against *S. fructicola* and *Cladosporium carpophilum*. Also, Red Kidney beans (*Phaseolus vulgaris*) and small limbs of pear, plum, apricot, and quince were sprayed to test their tolerance. In laboratory studies the new fungicide proved to be comparable in toxicity to Bordeaux mixture, and in field tests it compared favourably with standard treatments on all hosts except cherry, where it was not a sufficient protectant over a long period. The material did not injure any of the plants tested. The new fungicide is basic in character and is compatible with lime, bentonite plus lime, lead arsenate, and mineral oil, but not with bentonite alone or flocculated with nicotine sulphate; it is difficult to wet in water, but is readily dispersed by the addition of a small amount of a wetting agent.

Of a series of closely related diphenylamines tested, diphenylamine and 2′,4′-diamino-2-phenyldiphenylamine approached 2,4-diaminodiphenylamine in toxicity; 4-nitrodiphenylamine, 4-chlorodiphenylamine, and diphenylparaphenylene diamine were toxic to the conidia of *S. fructicola* but not to those of *G. cingulata*. None of the compounds except diphenylamine and 2′,4′-diamino-2-phenyldiphenylamine were injurious to Red Kidney beans.

Brown (J. H.) **A fungus culture slide.**—*Bull. Johns Hopkins Hosp.*, lxx, 5, pp. 460–462, 6 figs., 1942.

The following method has been devised for studying the development of a fungus, e.g., *Monilia* sp. and *Aspergillus niger*, from a single spore or mycelial fragment. The centre of a glass slide, 76 by 28 by 2 mm., is occupied by a polished, slightly depressed, concave table, 1 cm. in diameter, surrounded by two concentric moats connected by a short communicating moat, the outer one being similarly connected on the opposite side with the edge of the slide, which serves as an air inlet. Minute droplets of mineral oil are placed at six points on the slide—one at each side of the top and bottom of the outer moat and one at each side of the inner moat—and a full, large (4 mm.) loop of the inoculated medium (Sabouraud's agar) placed at the top of the central table. The preparation is then covered with a square 25 mm. cover-glass, below which the medium diffuses in the form of a circle broken by a notch, cut in the edge of the table on the same side as the air inlet. Contamination and desiccation of the medium are obviated by the restriction of air to that entering through the moats and the notch, while a humid atmosphere may be further promoted by incubation in a Petri dish containing a piece of moist filter paper.

Rahman (K. A.). **Legislation against plant pests and diseases.**—*Indian Fmg*, 111, 5, pp. 269–272, 1942.

This is a general survey of the present status and functions of legislation against plant pests and diseases, with special reference to Indian needs and conditions. The first line of defence in the (Indian) Destructive Insects and Pests Act, No. II of 3rd February, 1914, aims at the exclusion from the country of foreign pathogens, and the second at the eradication and control of such as have already gained entry, as well as of indigenous parasites. So far, only one out of eleven provinces and four out of 700 States have adopted the system of compulsory control: in Madras, however, where bud rot of Palmyra palm (*Phytophthora palmivora*) and sandal spike have already been extensively combated, the inhabitants are so convinced of the utility of legal measures that a petition has been submitted to the Governor-General for the obligatory extermination of cardamom mosaic. In the writer's opinion, the adoption of fixed standards of purity for plant protectives, similar to those obtaining in the United States since 1911, is highly desirable for India.